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Founded
1872

Monthly

Vol. 134
No. 2

INCORPORATING
Mechanics
AND HANDICRAFT

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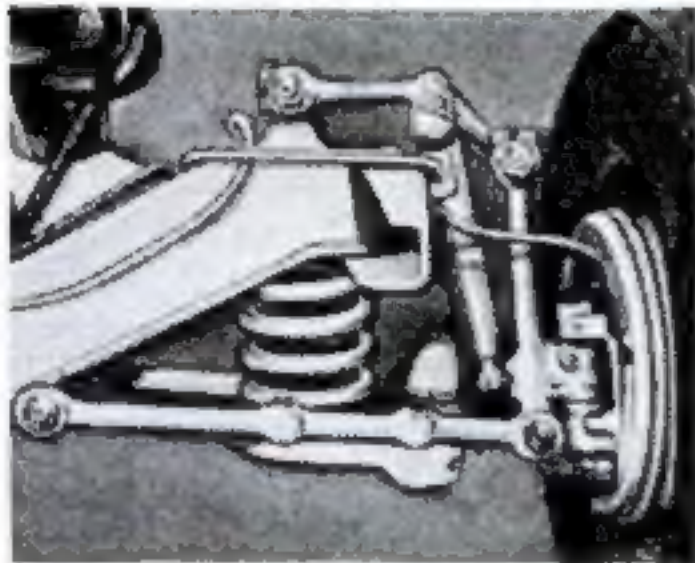
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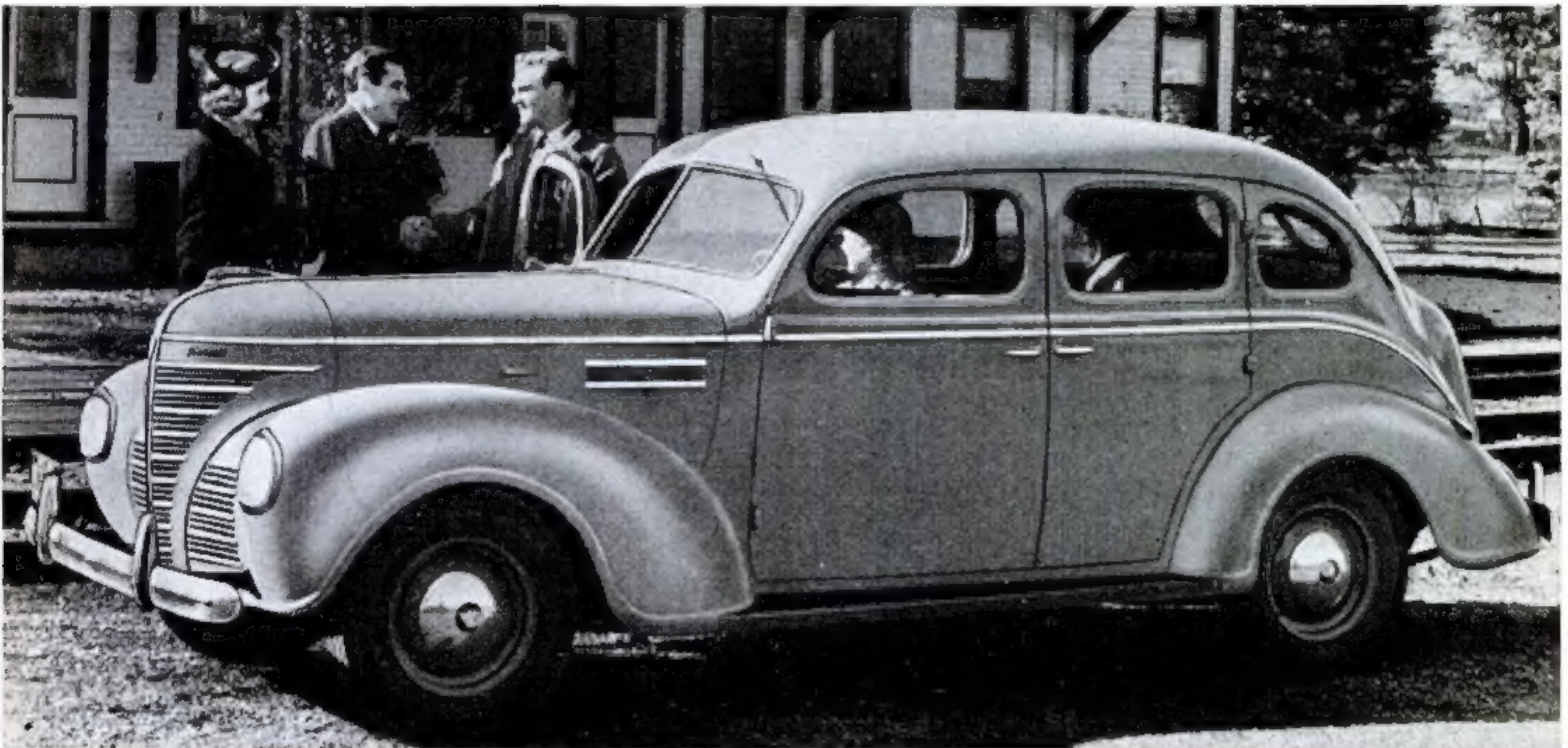
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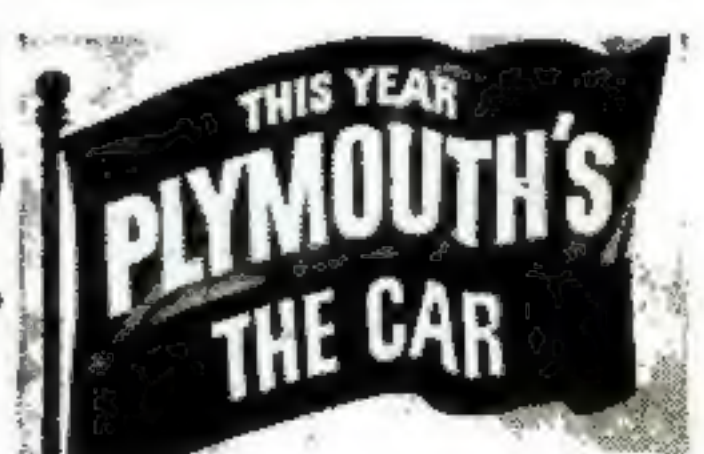
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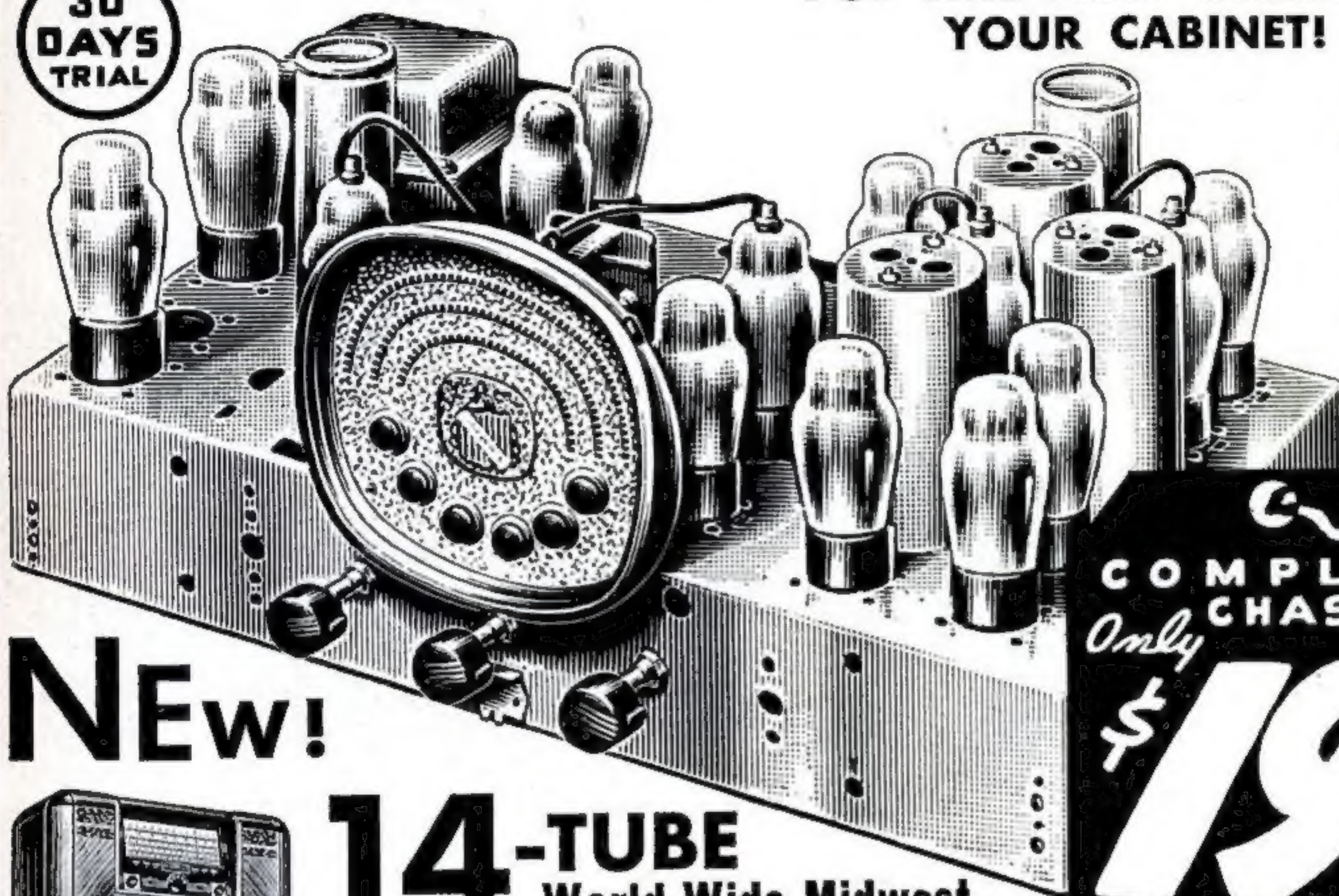
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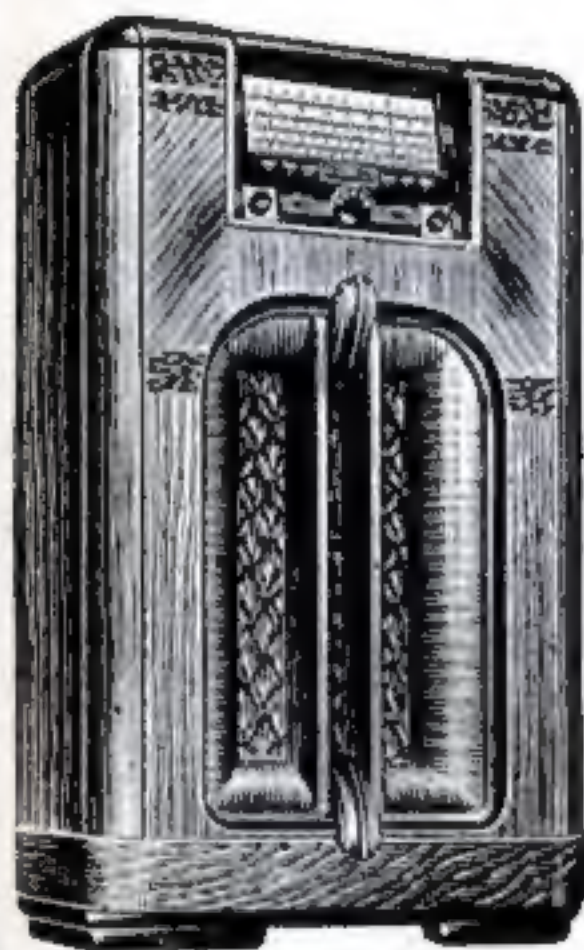
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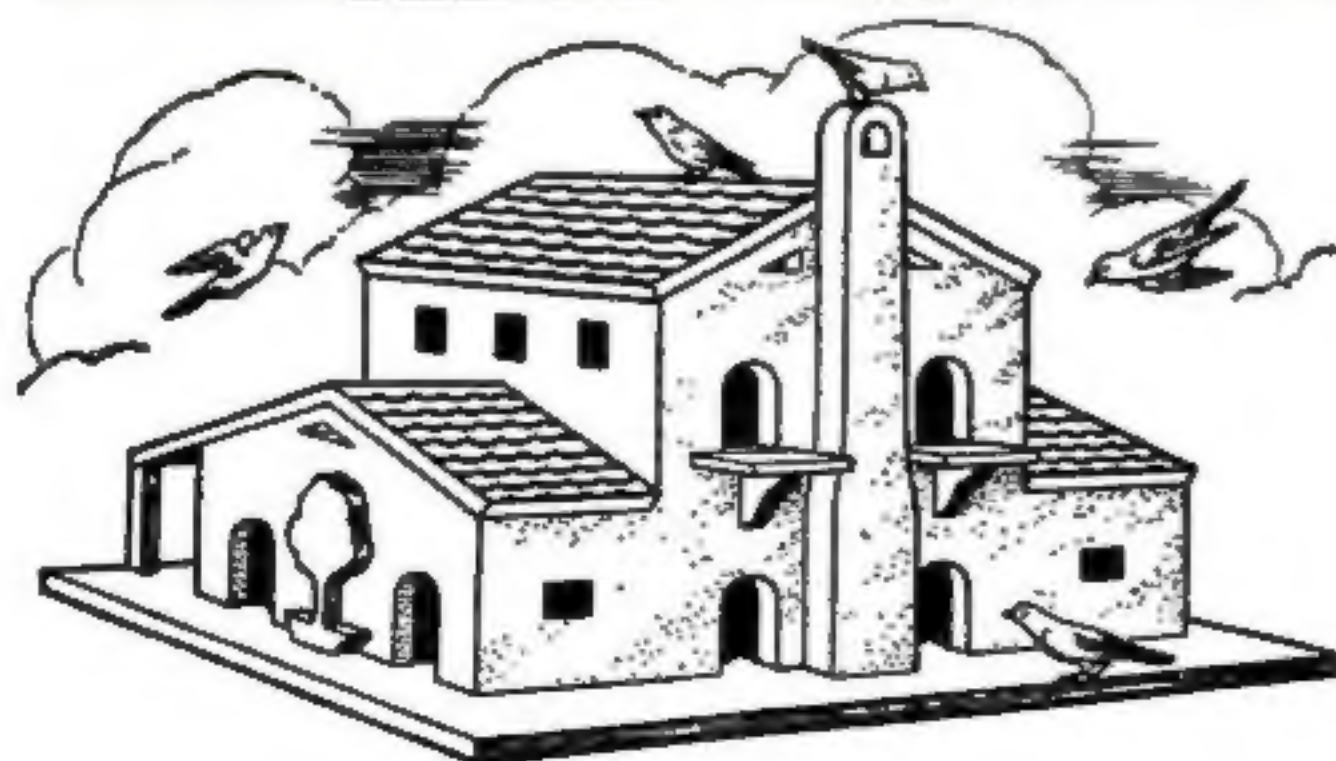
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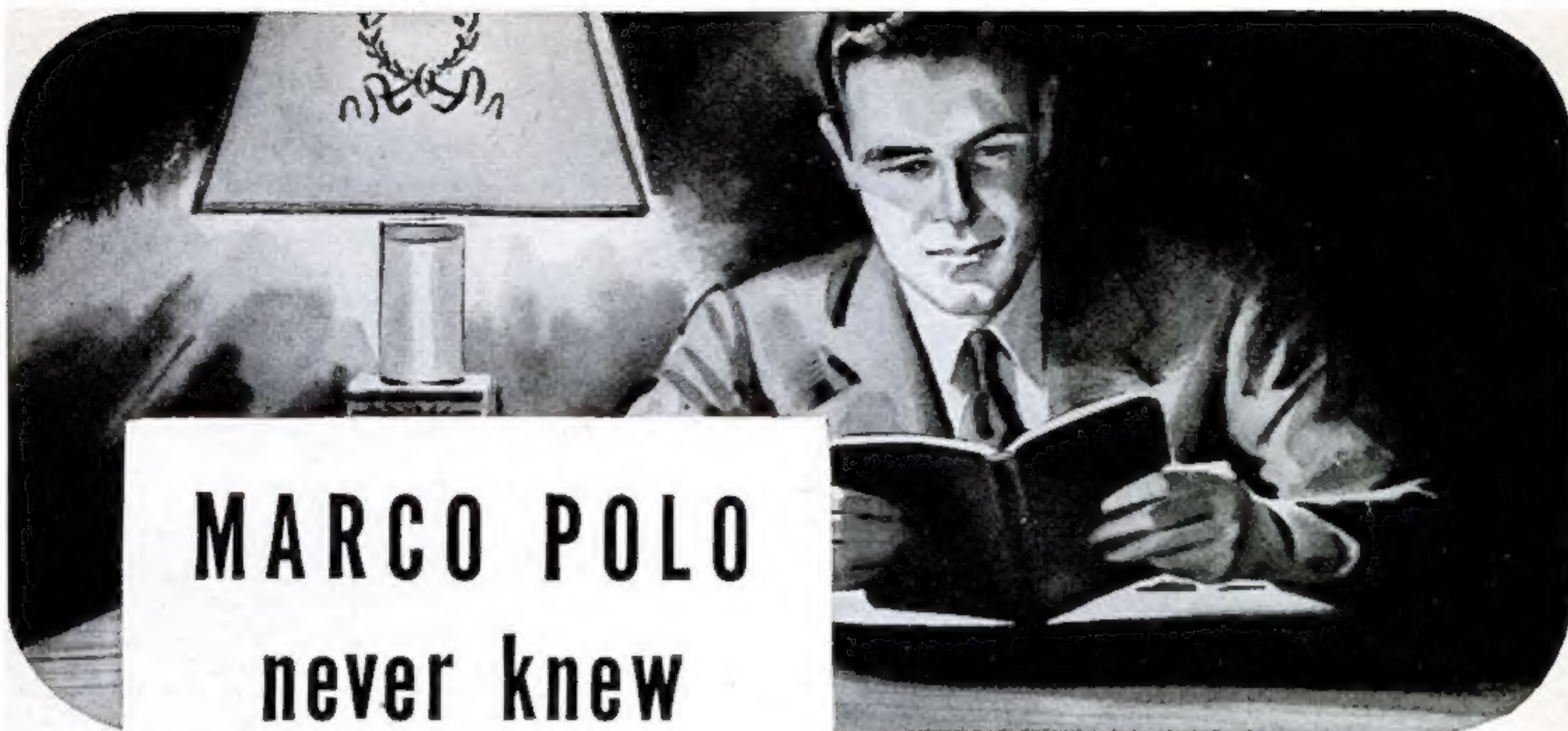
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NEW HOMES FOR BIRDS

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| <input type="checkbox"/> C. P. Accountant | <input type="checkbox"/> Advertising | <input type="checkbox"/> Railway Mail Clerk | <input type="checkbox"/> Lettering Show Cards <input type="checkbox"/> Signs |

DOMESTIC SCIENCE COURSES

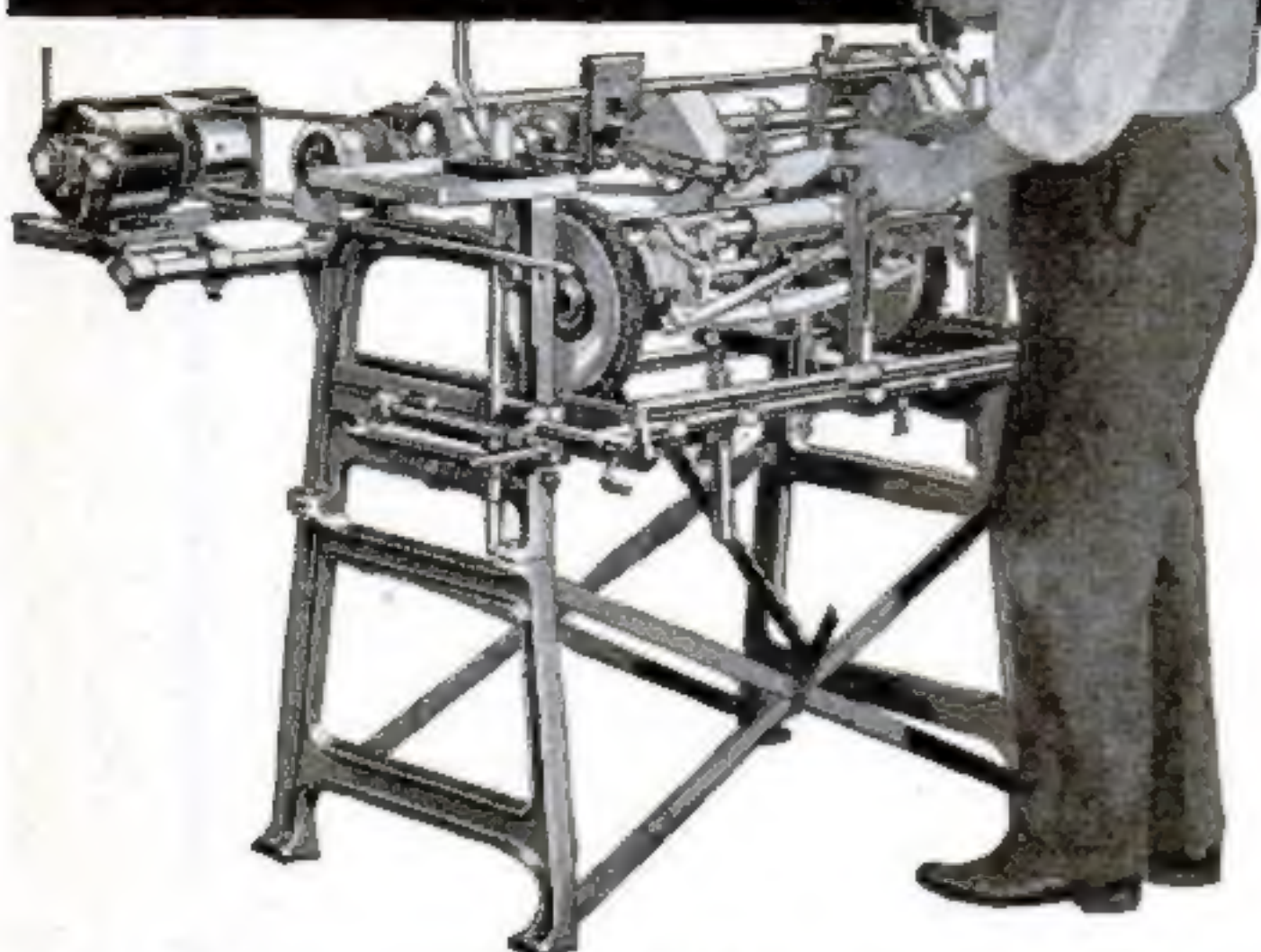
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|---|---|--|
| <input type="checkbox"/> Home Dressmaking | <input type="checkbox"/> Advanced Dressmaking | <input type="checkbox"/> Foods and Cookery |
| <input type="checkbox"/> Professional Dressmaking and Designing | | <input type="checkbox"/> Tea Room and Cafeteria Management, Catering |

Name.....Age.....Address.....

City.....State.....Present Position.....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada
If you reside in England, send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England

A BUSINESS OF YOUR OWN WITH AN IDEAL LAWNMOWER SHARPENER



Be Independent! Hundreds Now Have A Profitable Business Of Their Own—So Can You!

Our free plans show you how to build a successful business of your own sharpening lawnmowers. Most men earn up to \$25 a week. Roy F. Stier, Wisc., writes, "I paid for my Ideal Sharpener in exactly 36 days and have to-date sharpened 200 mowers at \$1.25 each. I live in a village of 500 people." Howard Hellen, Minn., writes, "I sharpened 745 lawnmowers, sold 60 used mowers and grossed \$1100.00 from April 5 to Sept. 15." A. J. Worth, Canada, writes, "It is necessary to buy another Ideal to handle the volume of business." A. M. Larsen, Utah, writes, "We average 9 lawnmowers a day." Chas. H. Chism, Ohio, writes, "I have had as high as 30 mowers come into my shop in one day." P. G. Armour, Pasadena, Calif. writes, "We get \$1.00 for small 4-blade machines, \$1.25 for 5-blades, \$1.50 for large mowers." Frank Segre, Hartford, Conn., writes, "My customers are so well pleased with the lawnmowers I sharpen for them, they always send in their friends. This makes good business for me."

EARN GOOD MONEY

FULL TIME OR SPARE TIME

Like magic, the Ideal Lawnmower Sharpener makes old, dull, badly worn mowers cut like new. Set the mower in the Ideal, make a few simple adjustments, and the machine does the rest. Sharpens any mower to a perfect edge in 15 to 20 minutes—usual charge \$1.00 to \$1.50. Customers come back year after year. Positively no experience necessary. Attach to light socket. Start in your basement or garage. Work in spare time only if you wish. Attachments for grinding skates, grass shears, hedge shears, sickles, scythes, and axes. FREE CATALOG tells complete story.

SEND POST CARD FOR FREE BOOK

The Fate-Root-Heath Co.
259 Bell St., Plymouth, Ohio

make money--
SHARPEN LAWNMOWERS!

HOW TO BUILD A Profitable BUSINESS OF YOUR OWN

Please mention POPULAR SCIENCE when writing to advertisers.

BOEING SCHOOL STARTS AVIATION CAREERS



The air industry looks to Boeing School for men trained to make good in aviation. Jack Knight, 2,400,000-mile ace pilot, says: "IF YOU WANT TO GET BEYOND FIRST BASE IN AVIATION, I RECOMMEND BOEING SCHOOL." United Air Lines founded Boeing School, closely supervises all Boeing courses. School buildings adjoin United's hangars at A-1-A Oakland Airport. Boeing School classes are kept small. Equipment is complete, modern. At Boeing School you're inside aviation! Write today for FREE 1939 BOEING SCHOOL BULLETIN. Describes Pilot, Ground, and Engineering courses. Gives lines of promotion. Tells opportunity for high school graduates. Address: BOEING SCHOOL OF AERONAUTICS, Dept. P-13, Airport, Oakland, California.

A DIVISION OF UNITED AIR LINES

AIR CONDITIONING AND REFRIGERATION TRIAL LESSON

FREE TRIAL LESSON

Trained men needed. Good pay. Opportunities. Learn easily AT HOME in spare time (or at our Chicago School). Send for FREE TRIAL LESSON. No charge for this now or later. Write today.

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B-332 Tech Bldg., 116 E. 26th St., Chicago, Ill.

Would you like to know AIRPLANE STRENGTH ANALYSIS



You can now enjoy training from courses prepared by outstanding engineers employed by major factories to train limited groups inside the industry. Basic Drafting and Design also available. Mathematics taught by our simplified design application method. Mail this ad today for free booklet, "Specialized Application Brings Greater Success."

WESTWOOD CORRESPONDENCE SCHOOL

Village Station, Los Angeles, Calif.

Industry Needs MECHANICAL ENGINEERS

Big opportunities for men with Engineering training. Promote yourself by preparing for jobs as Engineer, Superintendent, Master Mech., Factory Eng., Chief Draftsman, Gen'l Foreman. You mechanically employed men don't have to change lines to win promotion, but do have to get ready for jobs ahead. Write today for method for preparing for this well-paying profession. No obligation.

American School, Dept. M 246, Drexel at 58th, Chicago

CARTOONING

PAYS WELL

Turn your talent into dollars

Develop your ability with personal instruction from an internationally-known cartoonist. His exclusive, successful method of drawing and creating ideas makes it easy to learn. Write for Free Booklet explaining details of this exceptional home-study course. National School of Cartooning, 437-A Penton Bldg., Cleveland, Ohio



LEARN to DRAW-

beautiful girls' heads and figures from large photos of artists' models. Be an artist. Turn your talent into dollars. Simple method makes it easy. No experience necessary.

FREE SAMPLE CHARTS AND PICTURES

Send your name and address today, and only 10c to cover mailing cost. TRY IT FREE without obligation.

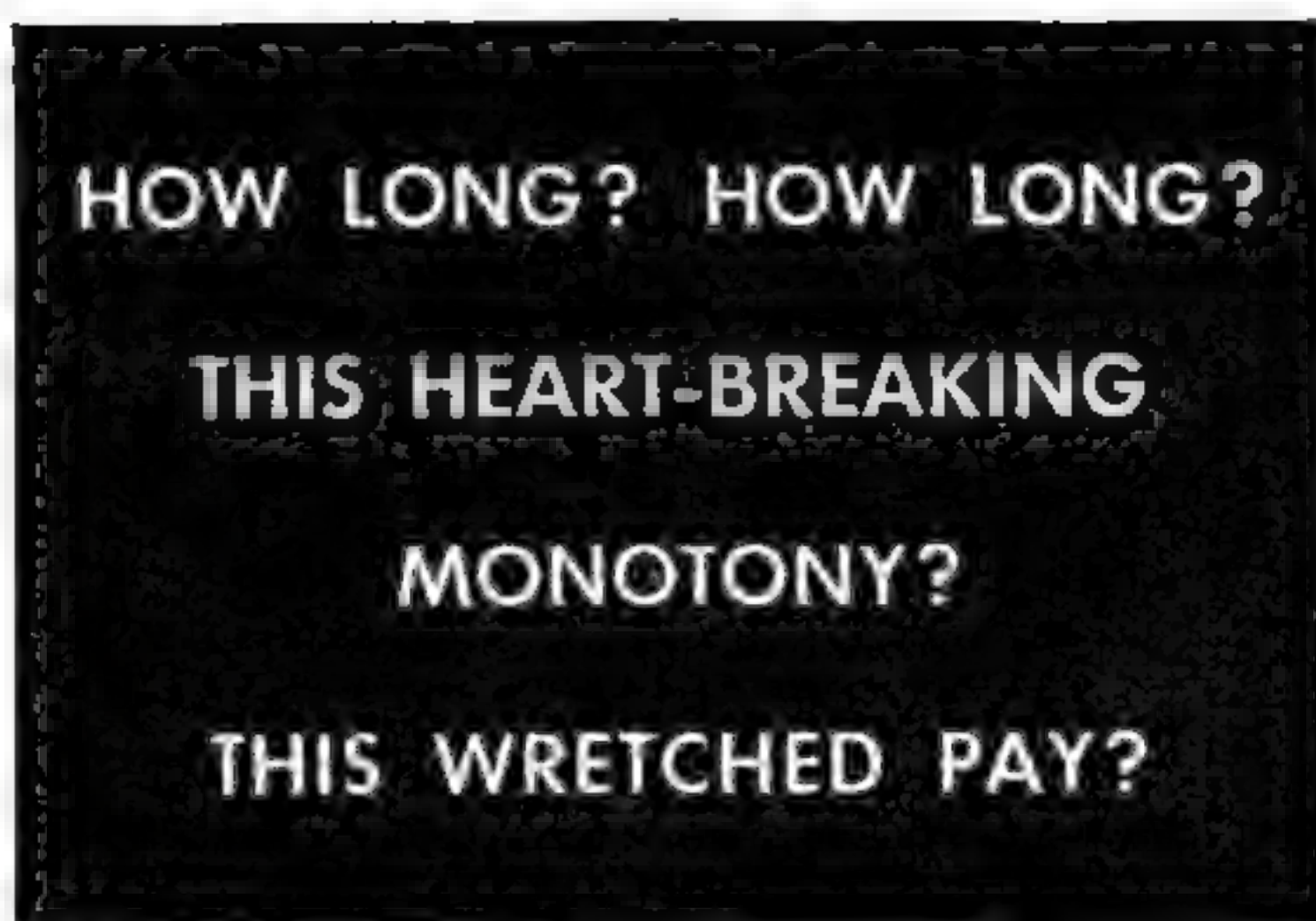
TOWERTOWN STUDIOS, Dept. 238
528 NORTH MICHIGAN AVENUE, CHICAGO, ILLINOIS

SEVEN WONDERS of the WORLD

FREE

Pictured in FULL COLOR—Each 7½ x 10½". Send only 10¢ to cover mailing costs. The wonders you have longed to see, reconstructed from recent discoveries and painted by famous artists, so you can view them at the height of their glory and read their stories. 24 page booklet. Educational! Entertaining! Mail 10¢ to

WM. H. WISE & CO., Dept. 802, 57 West 47th Street, New York City.



"If I Could Only Recover Those Ten Lost Years!"

[[The True Experience of a Man Who *Almost* Enrolled for LaSalle Home-Study Training]]

In December, 1921, an American employed with a mining firm in Mexico, clipped and signed a LaSalle advertisement coupon. *But he did not enroll!*

Ten years of silence followed . . . ten years of haphazard jobs, long hours, wretched pay . . .

Then, in January, *nineteen thirty two*, that silence was broken by a dramatic letter, high-spotted by these words: "Please send the first lessons with the least possible delay, as time is a highly important factor to me in this year of our Lord!"

Through five typewritten pages he recounted the hardships of those intervening years. A really able man, he had moved from one position to another, only to find advancement closed to him for lack of specialized training.

No need here to recite those hardships—though in justice to him it is only fair to say that on four separate occasions he had *almost* enrolled . . . and that on each occasion he had postponed action because of some unexpected reverse seemingly beyond his power to avoid.

"For five months now," so he wrote, "I have been 'on vacation.' Not a chance to take a course now—according to my carefully laid out and conscientiously followed program . . .

"But—supposing I had *chucked* that program at any time in the last 10 years? Supposing I had enrolled, in the face of seeming disaster, even though I had had to borrow the money to do it? Supposing even that I had enrolled only five months ago, at the beginning of my enforced vacation? In all likelihood I could have mastered the training by now. Or I might in the meanwhile have found a congenial and profitable position, thanks

LASALLE EXTENSION UNIVERSITY

A Correspondence Institution

Dept. 283-R

Chicago, Illinois

I would like to have your special booklet—without any cost or obligation to me—about my opportunities and your success training in the business field I have checked.

- ☐ Business Management
- ☐ Higher Accountancy
- ☐ Traffic Management
- ☐ Modern Salesmanship
- ☐ Commercial Law

- ☐ Law: Degree of LL. B.
- ☐ Expert Bookkeeping
- ☐ C. P. A. Coaching
- ☐ Industrial Management
- ☐ Modern Foremanship

- ☐ Business Correspondence
- ☐ Business English
- ☐ Effective Speaking
- ☐ Stenotypy

to my increased knowledge. As it is, for all I know, there may be another five months without any position . . . with all sorts of dim prospects . . . and meanwhile I am getting older . . .

"*That settles it! To blaze with further procrastination! To thunderation with my financial program! I've borrowed the money, and I'll borrow some more . . . but I'll do something with my time! This year is going to see a big change in my affairs—and right here is where we start!*"

Send for Free Booklet

These are searching times—and wise is the man who takes full measure of his competition . . . gets the special training that he needs . . . and thus commands the unfolding opportunities of our new-day business world.

If you need to be *convinced* of those opportunities, forget that you ever read this message. For those opportunities are not for you . . .

But if you are determined to be out in front when men are picked for leadership one year, two years, ten years from now—do not, on your life, risk a day's delay.

Below is a coupon. It will bring you—without cost—books that have led to increased earnings running into many thousands of dollars! Men of action—*hundreds of them*—will use this coupon for their personal advancement. Be one of those men who will steadily win their way to the better-salaried positions.



Ask for one of these booklets—or a similar one in your own field of business. They are **FREE!**

Name _____ Age _____

Position _____ Address _____

I Jumped from \$18 a week to \$50

--A FREE BOOK STARTED ME TOWARD THIS

Good Pay in Radio

--- HERE'S HOW IT HAPPENED

by S.J.E. (NAME AND ADDRESS SENT UPON REQUEST)



"When I finished training I accepted a job as serviceman with a Radio store. In 3 weeks I was made service manager at more than twice what I earned in the shoe factory."

BE A RADIO

Find out How I Train

Radio offers you many opportunities for well-paying spare time and full time jobs. And you don't have to give up your job, leave home or spend a lot of money to train to get those jobs to become a Radio Expert.

Many Make \$30, \$50, \$75 a Week

Radio broadcasting stations employ engineers, operators, station managers and pay up to \$5,000 a year. Fixing Radio sets in spare time pays many \$200 to \$500 a year. Full time jobs with Radio jobbers, manufacturers and dealers as much as \$30, \$50, \$75 a week. Many Radio Experts open full or part time Radio sales and repair businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, and pay up to \$6,000 a year. Automobile, police, aviation, commercial Radio, loud speaker systems are newer fields offering good opportunities now and for the future. Television promises to open many good jobs soon. Men I trained have good jobs in these branches of Radio. Read how they got their jobs. Mail coupon.

How You Get Practical Experience

I send you special Radio equipment; show you how to conduct experiments, build circuits illustrating important principles used in modern Radio receivers, broadcast stations and loud-speaker installations. This 50-50 method of training with printed instructions and working with

Many Make \$5, \$10, \$15 a Week Extra in Spare Time While Learning

The day you enroll, in addition to our regular Course, I start sending Extra Money Job Sheets; show you how to do Radio repair jobs. Throughout your training I send plans and directions that made good spare time money--\$200 to \$500--for hundreds, while learning.

Over \$1,000 Before Graduating

"Before completing half the N. R. I. Course I was servicing sets, and I made \$1,000 to \$1,200 before graduating. I am doing Radio service work for myself now."--ASHLEY G. ALDRIDGE, 1228 Shepherd St., Petersburg, Va.



\$10 to \$25 a Week in Spare Time

"I am making from \$10 to \$25 a week in spare time while still holding my regular job as a machinist. I owe my success to N. R. I."--WM. F. RUPP, 203 West Front St., West Conshohocken, Pa.

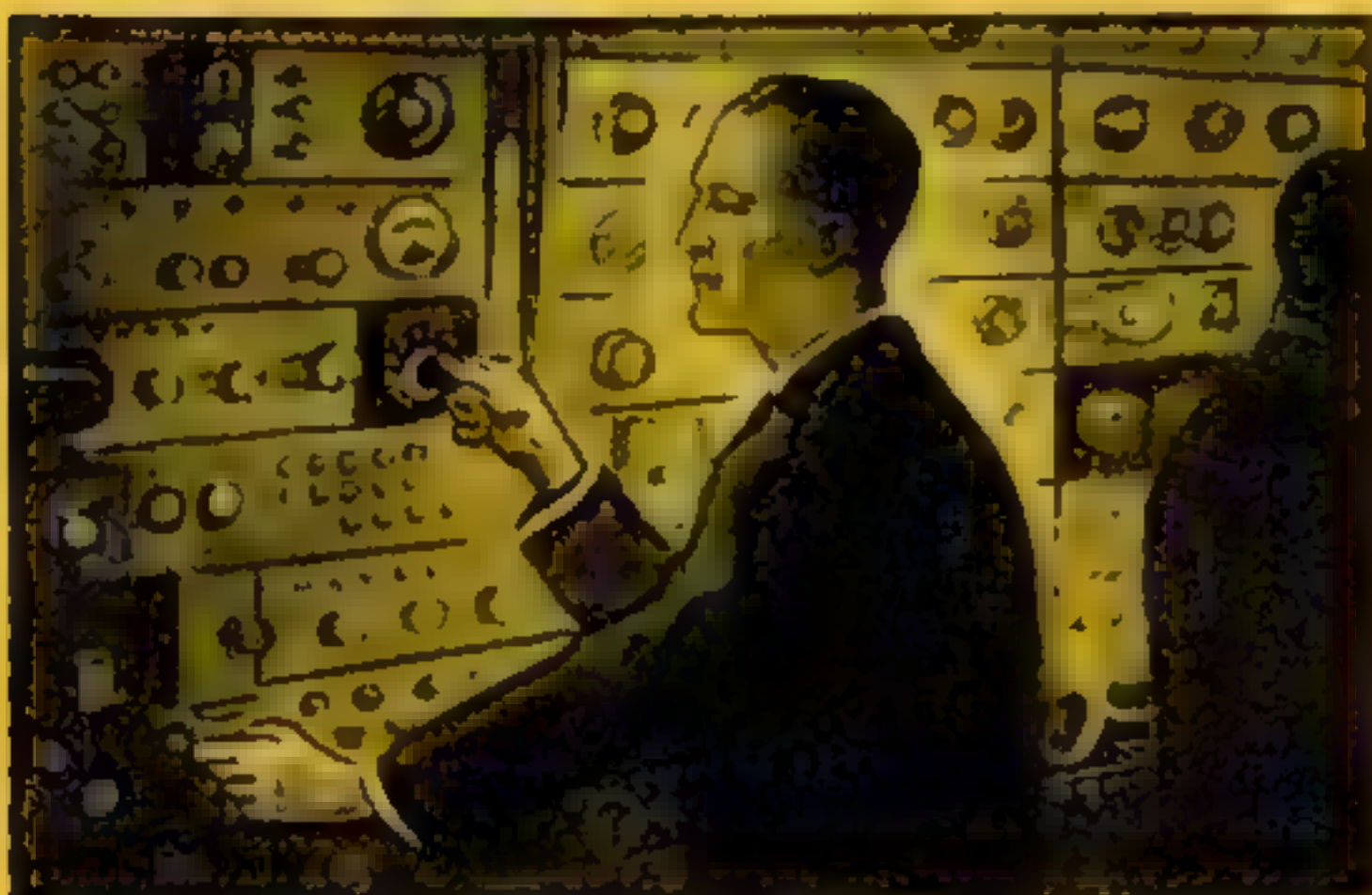




"I had an \$18 a week job in a shoe factory. I'd probably be at it today if I hadn't read about the opportunities in Radio and started training at home for them."



"The training National Radio Institute gave me was so practical I was soon ready to make \$5, \$10, \$15 a week in spare time servicing Radio sets."



"Eight months later the N. R. I. Employment Department sent me to Station KWCR as a Radio operator. Now I am Radio Engineer at Station WSUI. I am also connected with Television Station W9XK."



"N. R. I. Training took me out of a low-pay shoe factory job and put me into Radio at good pay. Radio is growing fast. The field is wide open to properly trained men."

EXPERT You at Home

Radio parts and circuits—makes learning at home interesting, fascinating, practical. I ALSO GIVE YOU A MODERN, PROFESSIONAL ALL-WAVE, ALL-PURPOSE RADIO SET SERVICING INSTRUMENT to help you make good money fixing Radios while learning and equip you with a professional instrument for full time jobs after graduation.

Money Back Agreement Protects You

I am so sure I can train you to your satisfaction that I agree in writing to refund every penny you pay me if you are not satisfied with my Lessons and Instruction Service when you finish. A copy of this agreement comes with my Free Book.

Find Out What Radio Offers You

Act Today Mail the coupon now for "Rich Rewards in Radio." It's free to any fellow over 16 years old. It points out Radio's spare time and full time opportunities and those coming in Television; tells about my training in Radio and Television; shows you letters from men I trained, telling what they are doing and earning. Find out what Radio offers YOU! MAIL COUPON in an envelope, or paste on a postcard—NOW!

J. E. Smith, President, National Radio Institute,
Dept. 9BP3, Washington, D. C.



J. E. SMITH, President,
National Radio Institute.
Established 1914

The man who has directed the home study training of more men for the Radio Industry than any other man in America



**MAIL THIS NOW
Get 64 Page Book Free**

J. E. SMITH, President, Dept. 9BP3,
National Radio Institute, Washington, D. C.

Dear Mr. Smith: Without obligating me, send "Rich Rewards in Radio," which points out spare time and full time opportunities in Radio and explains your practical method of training at home in spare time to become a Radio Expert. (Please write plainly.)

Name Age

Address

City.....State

Our Readers Say



And You Get More Than That During a Thunderstorm

IN CONNECTION with the television experiments now being carried on in New York City, I've heard that a meter connected to the antenna of a television receiver will show that

YEAH, BUT HOW MUCH LOSS IS THE PROBLEM!



the incoming signal often packs a wallop of one tenth of a volt. To me, that seems to be pretty good proof that the practical transmission of power by radio is not such an idle dream. If you can transmit a tenth of a volt with a television transmitter, it shouldn't be impossible to pipe a higher voltage through the ether with apparatus designed for the job.—J.M., New York, N.Y.

Check Your Answer to This Check Problem

HERE is one for your readers who like mathematical problems. A man received a check for a certain number of dollars and a certain number of cents, not to exceed \$100. The person cashing it for him accidentally gave him a number of dollars equal to the number of cents he should have received, and a number of cents equal to the number of dollars he should have received. He spent \$3 and then found he still had three times the amount of money the check called for. For what amount was the check written?—W.W.J., Cleveland, Ohio.

AW, THAT COULD HAPPEN ONLY IN A PROBLEM OR THE MOVIES



Photographer Exposes His Views on Direct-Printing Paper

WOULD like to have a word about the positive, photographic printing paper asked for by S.A.R., Chicago. The first photos—daguerreotypes—were really negatives, but backed up to appear as positives. Disadvantage: No copies. Development of the wet-plate negative, permitting copies as required, was a great boon. However, for those wanting direct positives, how about the commercially manufactured direct-positive paper? Of course, this has disadvantages, too.—V.J.R., Hopewell, Va.

Here's a New One for the Viewers-with-Alarm

MAYBE the old Chinese saw to the effect that one picture is worth 10,000 words is right. Maybe it isn't. But it looks to your gloomy correspondent as if the camera and all its horde of photographic children are heading the world for a new all-time high in illiteracy. It won't be long before it will be a waste of time to learn to read. You can get novels and dramas at any moving-picture theater. You can get the news in photos in tabloid newspapers and rotogravure sections. You can follow through whole stories without reading a caption in the photographic sets printed in the latest picture magazines. Photography has become a sort of Esperanto, replacing the English language. In time, it seems likely, it may create a new kind of picture writing. Then, nobody will read. Everybody will just look at pictures!—A.E., Brooklyn, N.Y.

No Rest for the Weary in His Bathtub

ON PAGE 28 of the November issue, I read an article about a device which has been designed as a headrest for bathtubs. It may serve the purpose, but I would like to know who wants to rest in a bathtub. I have been under the impression that the bathtub was made to take a bath in, not to rest in. I think we have things called beds for those who are tired to rest in, and you can't beat a good feather pillow for a headrest.—C.B.A., Esterly, Pa.

HOW ABOUT THE GALS IN THE ADS? DOOMED FOREVER TO SIT IN A TUB!



Wanted: More Science and Less Doll Furniture

THE change in size, binding, the new features, and the up-to-dateness of P.S.M. are greatly appreciated. But please don't forget us readers who prefer experimenting with and constructing such things as Tesla coils, stroboscopes, and other things electrical, to making doll furniture. To satisfy those home-workshop owners preferring science to craftwork, P.S.M. must have more science, especially experimental science (Continued on page 14)

You Ask Me What I Am Doing?



I Am Getting Ready to Earn More Money ... Preparing for a Bigger Job

I am a student of the American School, Chicago. A little more than half way through my course—already my increased knowledge has brought me promotion as a result of the hour or so a day I have been spending getting acquainted with the principles of the work I enjoy. I use only part of my spare time, so it doesn't interfere with my home and social life, and certainly helps me on the job.

I have been surprised at the practical manner in which even advanced work is explained. It is a lot easier than I had expected. I only wish I had started this plan of getting ahead a few years earlier. But when I was 18 to 20 I felt pretty sure of myself. I didn't take enough stock in what more experienced people told me about the importance of being thoroughly trained for the job I wanted.

You Can't Win If You Don't Try

American School, Dept. G246, Drexel Ave. at 58th St., Chicago

CUT ALONG THIS LINE

Try a Lesson Yourself—No Obligation

American School, Dept. G246, Drexel Ave. at 58th St., Chicago

I have checked the line of work in which I would like a good job. Please send me without expense or obligation on my part a copy of your Bulletin and an early lesson in the field I have selected.

- ☐ Air Conditioning
- ☐ Architecture
- ☐ Automotive Engineering
- ☐ Automobile Repairing
- ☐ Bookkeeping and Cost Accounting
- ☐ Business Management
- ☐ Civil Engineering
- ☐ Aviation
- ☐ Contracting, Building

- ☐ Electrical Engineering
- ☐ Diesel Engineering
- ☐ Drafting and Designing
- ☐ Electric Refrigeration
- ☐ Heating, Ventilating, Plumbing
- ☐ Professional Accounting Incl. C. P. A. Coaching
- ☐ High School
- ☐ Highway Engineering

- ☐ Law
- ☐ Liberal Arts (College)
- ☐ Mechanical Engineering
- ☐ Merchandising
- ☐ Private Secretary
- ☐ Radio and Television
- ☐ Salesmanship
- ☐ Shop Practice
- ☐ Steam Engineering



Name _____ Age _____ Occupation _____

Street _____ City _____ State _____

Our Readers Say (CONTINUED)

that is found fascinating and intriguing by many; for example, how to make sensitive meters, experimental vacuum tubes, or even a Geiger counter.—W.H.R., Jr., State College, Pa.

That "Swiss Papa" Couldn't Take Back-Seat Yodeling

THAT family "bicycle" that carries nine people, including Mama and if necessary, I suppose, Mama-in-law, has the Sunday-driving problem licked! I note with extreme delight that it has two steering wheels and that five persons may provide the power. What a break for the belabored father who takes his family on Sunday drives only to have his wife tell him to stop, start, go slower, faster, turn around,

be careful, and so on, and whose kids are fast developing similar executive propensities! With one of those contraptions, Father can at any time give up the wheel to Mother, and say, "Go wherever you like. From now on I'm just a passenger," or say to the kids, "All right, if you want to go faster, get busy and push!" And, if matters get altogether out of control, he can always assert his authority by applying his individual coaster brake. Three cheers for that Swiss papa. He knows what it's all about!—S.A.P. (stands for Strictly Anonymous Papa), Washington, D.C.

How These Modern Cars Do Stand Up!

ALTHOUGH I have not been a regular subscriber of your magazine, I have not missed one issue in many years—about twenty of them. Have always enjoyed it; also found your advertisers unusually reliable. In this connection, I might mention that my home-workshop expenditures are somewhat above average. Several years ago, I wrote you requesting information about steam automobiles. Rather late to thank you, but thought you might be interested to know that, of the several concerns I wrote to, yours was the only one that knew anything about them. The result was that our 1909 Stanley Steamer was put back in commission for my youngster. Do not know of anything that has given her more pleasure.

IN THE
GROOVE!

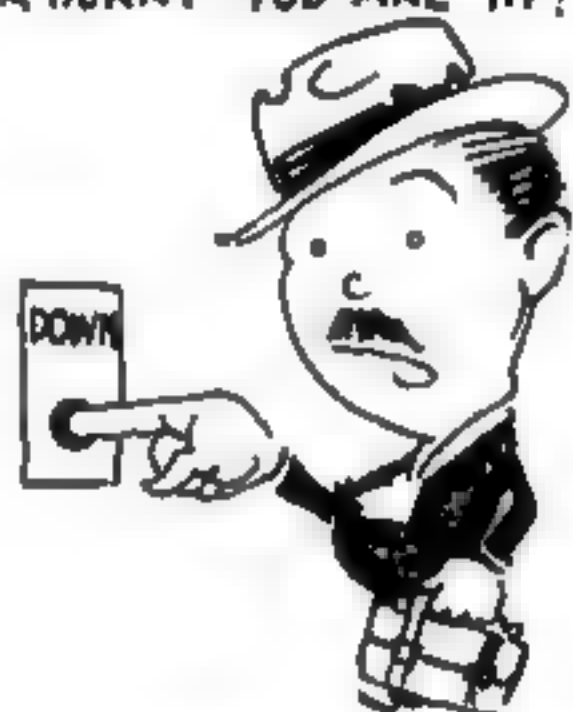


It is still running perfectly today. Thanking you for your attention.—L.S.W., Macon, Ga.

His Experience Might Indicate That the Chances Are Slim

HERE is a simple but amusing little problem. There are two elevators in an office building, and you are on the top floor, waiting for one. Stationary indicators show that both elevators have stopped at the middle floor, and you don't know which direction either one is going to take when it moves. What are the chances, when they start, that at least one of them will be coming up? I assume, of course, that there are no arbitrary rules that interfere with the normal operation of the laws of chance.—B.H., Pittsburgh, Pa.

DEPENDS ON HOW MUCH OF
A HURRY YOU ARE IN!



Will Some Astronomer Help This Philologist?

COMPLIMENTS, W.S.P., of Trenton, N.J., on your intelligent idea that fans submit their puzzlers to "Our Readers Say." Perhaps I can help in clearing up that question, "Where did the expression 'O.K.' originate?" Well, the correct spelling is "okeh;" it came from the language of the Choctaw Indians, a tribe of the southern part of the U.S.A., east of the Mississippi. Translated, "okeh" means "it is so." Perhaps some of our fellow readers can tell me why some stars (non-Hollywood) appear to be red.—T.W.C., Montreal, Canada.

WHAT ALPHABET DID THE
CHOCTAWS USE TO SPELL
"OKEH"?



Poison Gas, Heh? Roll Over and Go to Sleep!

YOUR article in the December issue, "Safety Caravan Hauls Poison Gas," was rather amusing to one familiar with chlorine. Such superlatives! Poison, bottled death, poisonous chlorine, trucks moving at about five miles an hour, etc! I presume a lot of this bunk is a hangover from the World War. A study of the residual effects of warfare gases revealed that ninety-seven and four tenths percent of those supposed to be injured by inhaling chlorine were gassed by something entirely different, not chlorine at *(Continued on page 16)*

ACCIDENT or SICKNESS

This Can Happen to You!



Thousands of people are disabled every hour of the day. Don't let sickness or accident find you unprepared. Get a "Security" policy. The cost is so low that you cannot afford to be without this protection.

THE SECURITY POLICY

* PAYS YOUR EXPENSES

\$3,750⁰⁰
ACCUMULATED BENEFITS
FOR ACCIDENTAL DEATH,
Loss of Hands, Eyes or Feet

The "Security" Accident and Sickness Policy will protect you, and give your family quick cash money to pay the bills when your income is stopped. Think of it—cash money when you need it most! This remarkable policy pays CASH protection of \$25.00 a week up to one full year for accident—\$25.00 each week up to ten weeks for sickness—and cash protection up to

\$3,750.00 for accidental death, loss of hands, eyes or feet. Also other liberal features. All this for only \$1.00 a month! You cannot afford to pass up the opportunity to examine this new Security Policy on our 10-day Free Inspection Offer!

COSTS ONLY
\$1⁰⁰
Per Month

\$100⁰⁰ PER MONTH
FOR ACCIDENT

AGES 16 to 75—NO PHYSICAL EXAMINATION

If you are between the ages of 16 and 75, man or woman, send coupon below at once. No medical or physical examination. No agent will call. The Arcadia Mutual Casualty Company is a reliable, safe, dependable company—not an association or assessment company. It has the approval of the Illinois State

Insurance Department and offers you this unusual policy through the Central Insurance Agency. Because of the liberal benefit features only one "Security Policy" will be issued to each person, but any person may apply. Don't delay! Send coupon today for complete information how to get the Security Accident & Sickness Policy for your free inspection.

\$100⁰⁰ PER MONTH
FOR SICKNESS

SEND NO MONEY

\$100⁰⁰
FINANCIAL AID

Send no money with this coupon. At no cost to you, we will send you complete information and tell you how to get the Security Accident & Sickness Policy for Your Own Free Inspection—in the privacy of your own home!

\$100⁰⁰
HOSPITAL

MAIL COUPON TODAY

No agent will call. You alone judge and decide. Don't wait until it's too late. You never know when an accident or sickness may come—be prepared. Act now. Send the coupon today without obligation.

THE ARCADIA MUTUAL CASUALTY COMPANY,
 Central Insurance Agency, Inc., Desk 18
 75 East Wacker Drive, Chicago, Ill.
 Please send me complete information at once and tell me how I may get the "Security" Policy for 10 Day Free Inspection without obligation. No agent will call. I am to be the sole judge.
 Name
 Street or R.F.D.
 City..... State.....

* All as specified in the Policy

Our Readers Say (CONTINUED)

all. Admitted that chlorine is not pleasant; it is very irritating and, in sufficient quantities, might displace all the oxygen so that the process then becomes merely one of suffocation. But it isn't poisonous. The drums shown in your illustrations are about three eighths of an inch thick, not one inch. However, although carrying 150 pounds pressure, they are frequently tested to 1,000 pounds as required by the Interstate Commerce Commission. So there is no occasion to lie awake "in the early hours of the morning" when a caravan creeps by at a "snail's pace." Roll over and go to sleep!—C.R.W., Tonawanda, N.Y.

Is P. S. M. Unfair to Unorganized Science Fans?

CONGRATULATIONS on having the best science magazine out today, and also on the new size, which I have been waiting for. And say, those color plates certainly make the magazine attractive. Now, here's something which I have been thinking about. You sponsor a craftsmen's guild, which is fine for those many shop fans, and believe me I envy them, for we poor science fans have no such organization. Why not? On my street alone, there are enough chemistry and microscopy fans to form a club, and believe me, they are all

YOU MUST ORGANIZE!



dyed-in-the-wool P.S.M. fans. How about it?—T.N., New York, N.Y.

They'd Be Easier on Tires, Pavements, and Your Nerves!

AFTER bouncing and sliding around in my car fitted with tire chains for the past several weeks, I've been wondering why some ingenious guy hasn't devised a set of mesh-type tire chains—flexible chain woven crisscross fashion in the small hexagonal pattern used in chicken netting, and fitting snugly over the wheel like a tire cover. Traction certainly wouldn't be lacking, there would be less chance of sideslipping, broken links wouldn't hammer dents in fenders, and they would eliminate the continuous bump-bump you get with single-cross-link chains.—H.W.G., Flushing, N.Y.

He Answers the Circles Problem, But Doesn't Get a Round Number

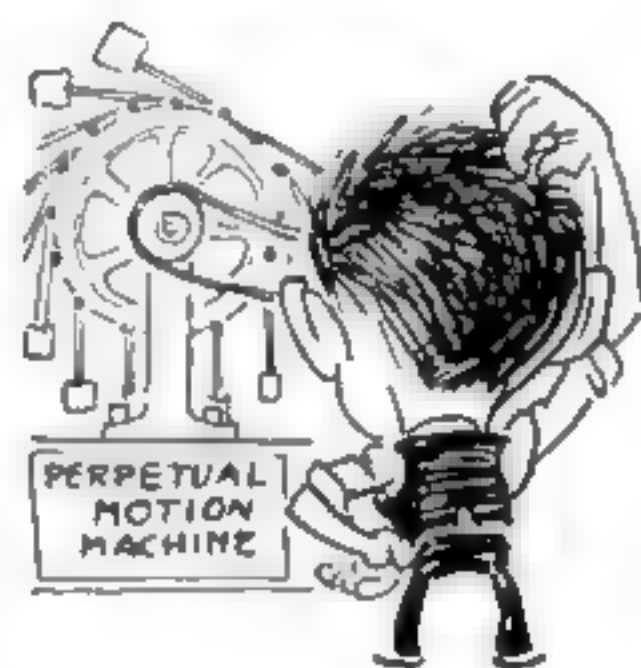
W.S.L.'S PROBLEM in the December issue was a simple one. The answer, correct to five decimals, is 3.724965. By connecting the centers of the sets of small circles given in each diagram, an equilateral triangle is formed in one large circle, and a square in the other, both figures

having sides of two inches. Two thirds of the altitude, plus one (radius of the small circles), equals the radius of one of the large circles, and one half the diagonal of the square, plus one (again the radius of small circles), equals the radius of the other large circle. Having their radii, it is now only a matter of computation to find their areas.—W.J.W., West New York, N.J.

A Car Without Gears That Works—on Paper

WITH reference to your article describing the liquid clutch—"Good-bye Gearshift!"—for the past ten years I have spent a lot of time designing a "hydraulic transmission" which eliminates all gears in the conventional drive system. If this new liquid clutch is successful, my hydraulic transmission will certainly be as great an improvement as I have hoped. I have lacked facilities and finances to make an actual model, although it works fine on paper. Your magazine is just my style, and I am pleased to be a new subscriber.—H.L.O., Columbia Falls, Mont.

FUNNY. IT WORKED FINE ON PAPER!



That Spirometer Can Be Two Machines in One

WAS interested in R. H. Jenkins's spirometer, on page 189 of your December issue, because it can so easily be converted into an accurate and practical scale. Merely shorten the rubber tubing and extend the glass tubing, fastening it upright on a board. Fill the apparatus with water colored with a few grains of potassium permanganate. The inner cylinder should be out at its limit. Place a one-pound weight on the top of the stove pipe and mark the height of the water in the glass tube on the board. This will be at a certain distance from the height of the water with no weight on the pipe. Divide this distance into sixteenths, and make corresponding marks on the board. Thus you can weigh objects in terms of ounces simply by placing them on the top of the pipe and reading from the scale. This should be much more valuable than a spirometer, but if anyone wants to use it as a spirometer, it still is possible.—R.P.J., Arlington, Mass.

FINE! NOW MAKE A BAROMETER OR SOMETHING OUT OF IT





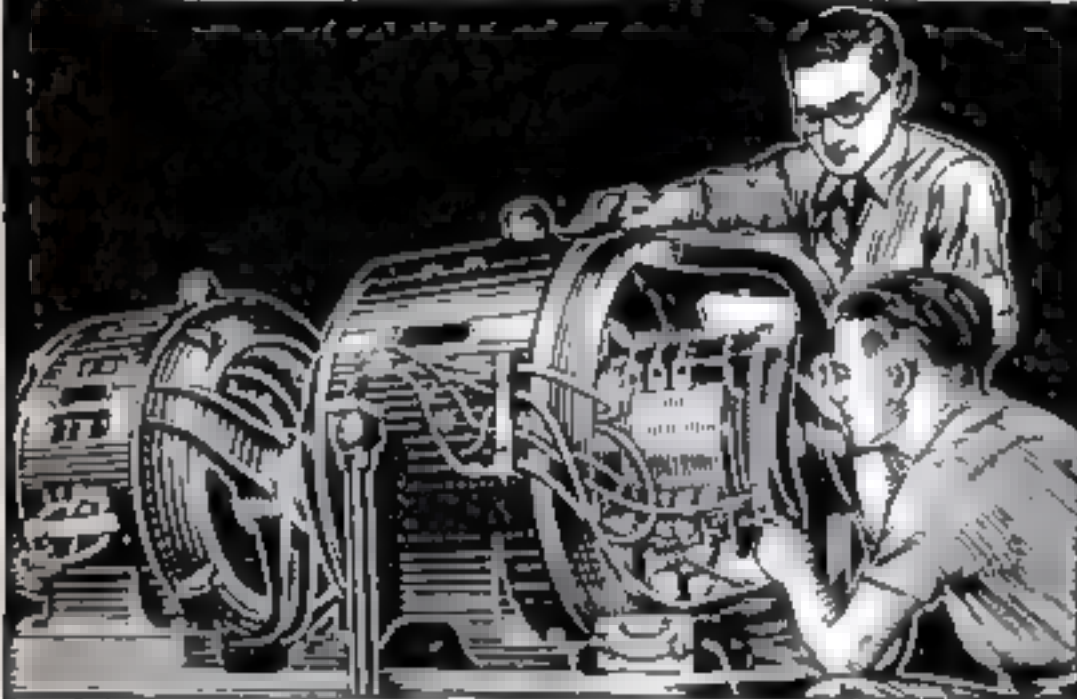
H. C. Lewis

QUICK, EASIER WAY ELECTRICITY

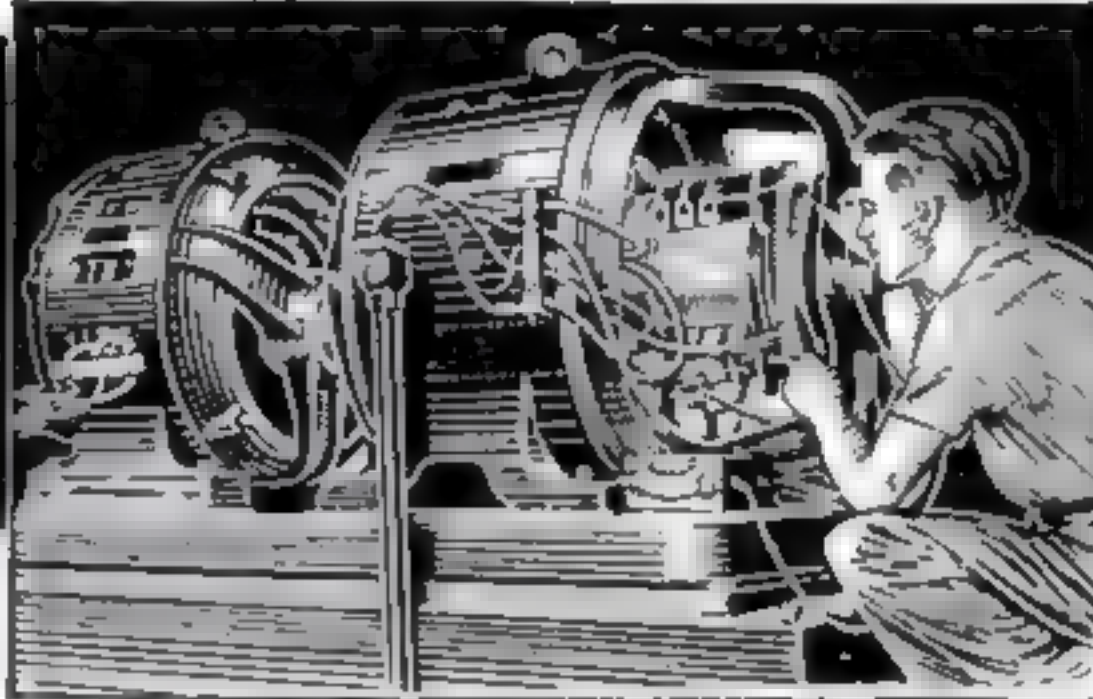
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FOR

12 Weeks

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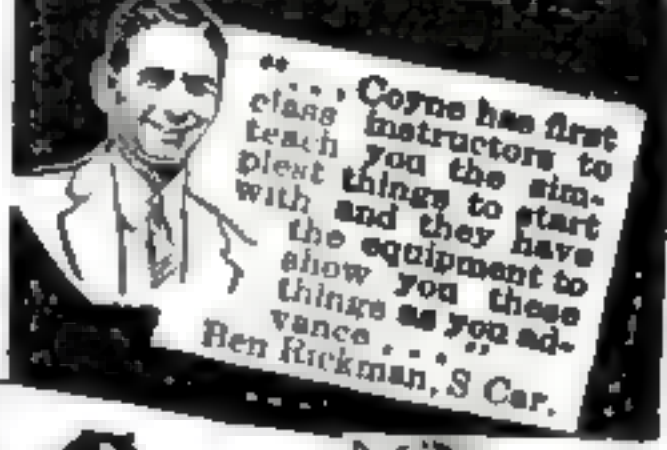
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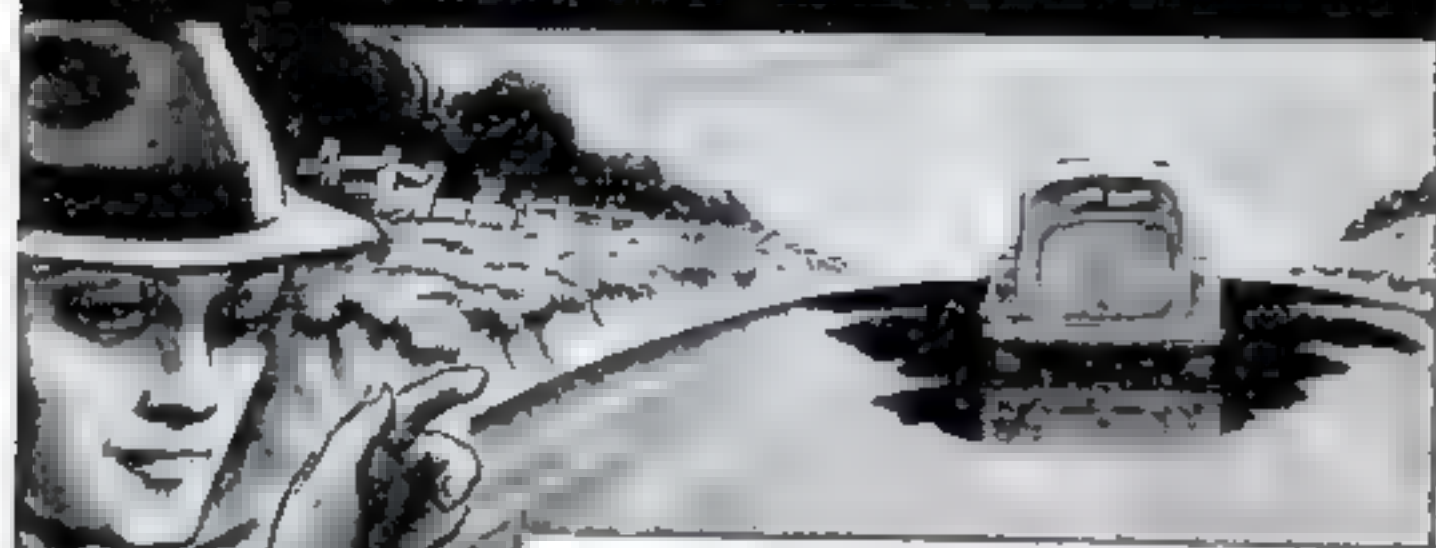
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YOU know that Traffic Management TODAY is one of the important departments of business—that it is a profession offering unusual opportunities, and pays many men three, five and seven thousand dollars a year and more.

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And the answer lies in the LaSalle Problem Method.

For this modern plan of training not only makes Traffic Management study at home thoroughly practical but makes it interesting as well.

You Learn by Doing

Suppose it were your privilege every day to sit in conference with a traffic manager or with a successful commerce practitioner. Suppose every day he were to lay before you his problems, and were to explain the principles by which he solves them. Suppose that one by one you were to work those problems out—returning to him every day for counsel and assistance—

Under the LaSalle Problem Method you pursue, to all intents and purposes, that identical plan.

Only—instead of having at your command the counsel of a single individual—one traffic expert—you have back of you the organized experience of a great business training institution, the authoritative findings of scores of able traffic executives, the actual procedure of successful practitioners.

Thus you are coached in the solving of the very problems you must face in the higher traffic positions. Step by step,

you work them out for yourself—until you have the kind of ability and experience for which business is willing and glad to pay real money—just as it was glad to pay these men.*

Five Men Who Tested and Proved It for You

For instance, there was the traffic clerk—with two years experience—whom LaSalle training helped move up to Traffic Manager and to a salary increase of 100 percent.

There was the railroad clerk who became Traffic Manager of a great organization with a salary several times his highest expectation as a clerk.

And another railroad clerk who was earning \$55 a month and achieved an income of more than \$10,000 a year as head of his own traffic bureau.

Another man—already a successful, experienced traffic manager—cut his firm's freight costs from four percent of gross sales to two percent—on a sales volume running into millions—and his salary was more than doubled.

A fifth man—an assistant pur-

chasing agent—seeing the need of a traffic department for his firm, took this training and sold the firm on the value of creating such a department. The new department promptly proceeded to save money—as high as \$50,000 a year—and the new manager was rewarded accordingly. Today he is Director of Traffic and Assistant to the General Works Manager—with several traffic men under his direction.

LaSalle-Trained Traffic Men Everywhere

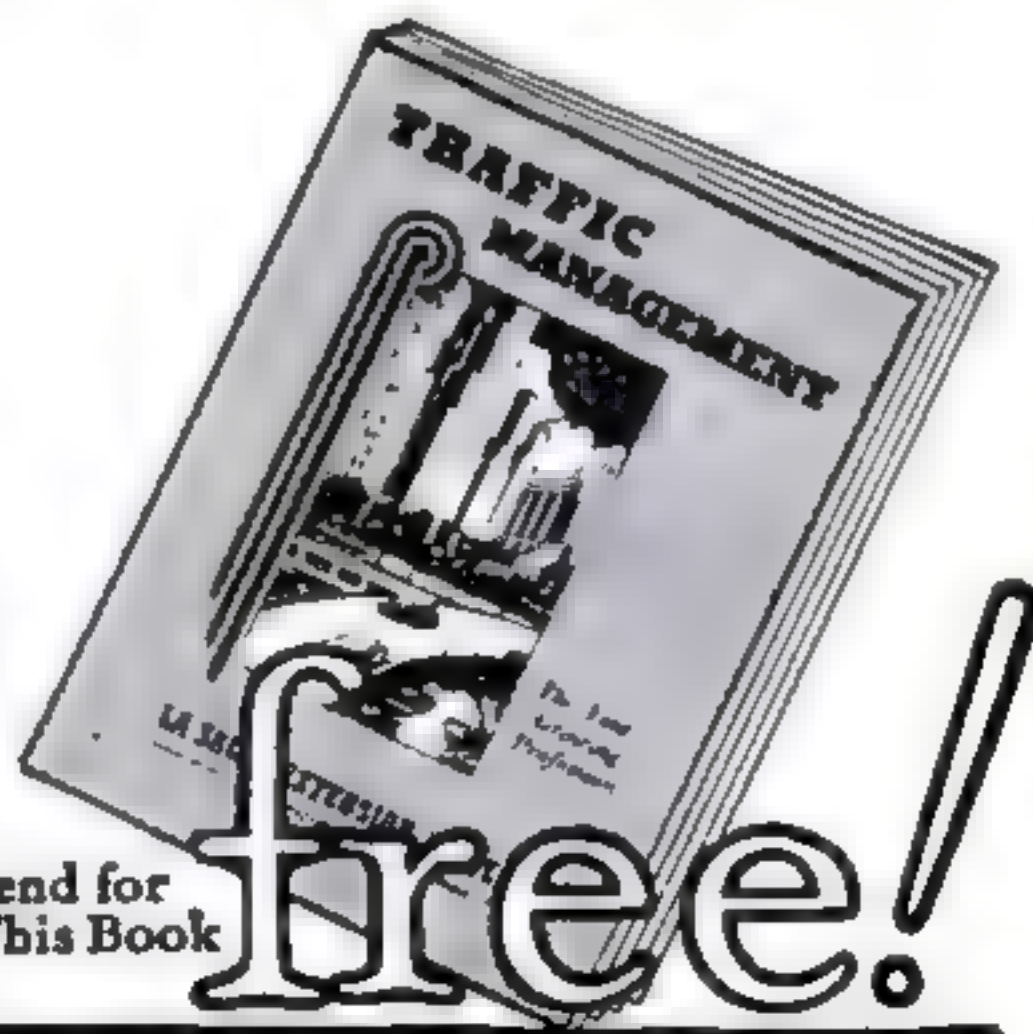
LaSalle traffic men are found wherever traffic men find a field for their services. They are serving commercial and industrial organizations; railroads and other transportation companies; chambers of commerce; trade associations and state and federal commissions. They are officers and active members of traffic clubs and national traffic organizations, and registered practitioners before the Interstate Commerce Commission.

Knowing these facts, ask yourself if there can be any further question about the practicability of this training for you—ask rather if the real question is not about your own ambition and your determination.

For Traffic Management is no magic wand for the lazy or the fearful or the quitter—it offers success only to the alert adult who has the courage to face the facts and the will to carry on.

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The inventor of the lathe was a farmer's son. There was no one to show Thomas Blanchard how to do the things his mechanical bent inclined him to try. He started by making an apple-parer while at school. Working in his brother's tack factory, at West Milbury, Massachusetts, Blanchard determined to make tacks by machine, instead of by hand. His own brother belittled the idea. Tom persisted in working at it after his day in the factory. One day, after six years of experiment, he showed his tack-making brother how to turn out 12,000 an hour with a wonderful machine, patent on which brought Blanchard \$5,000.00.

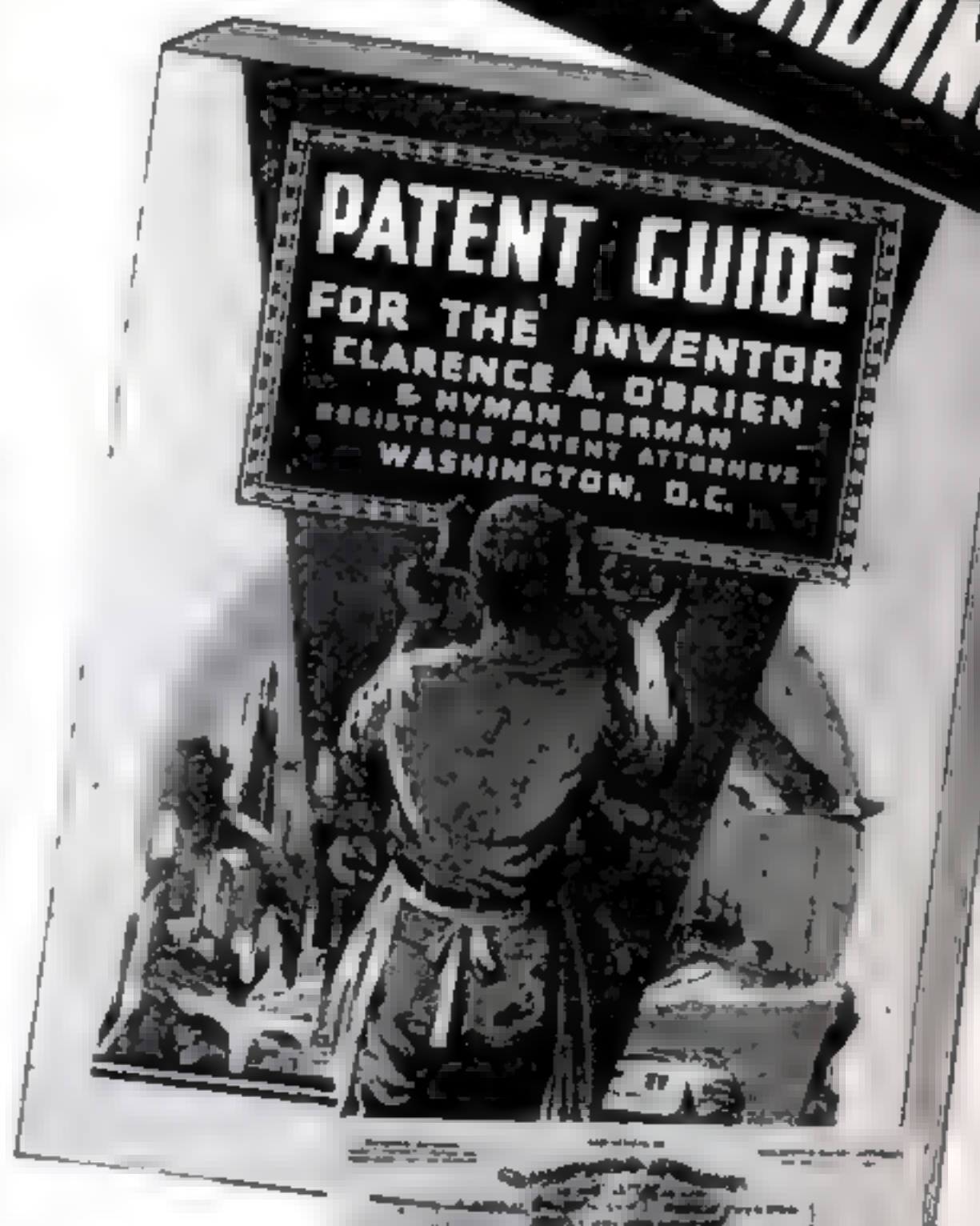
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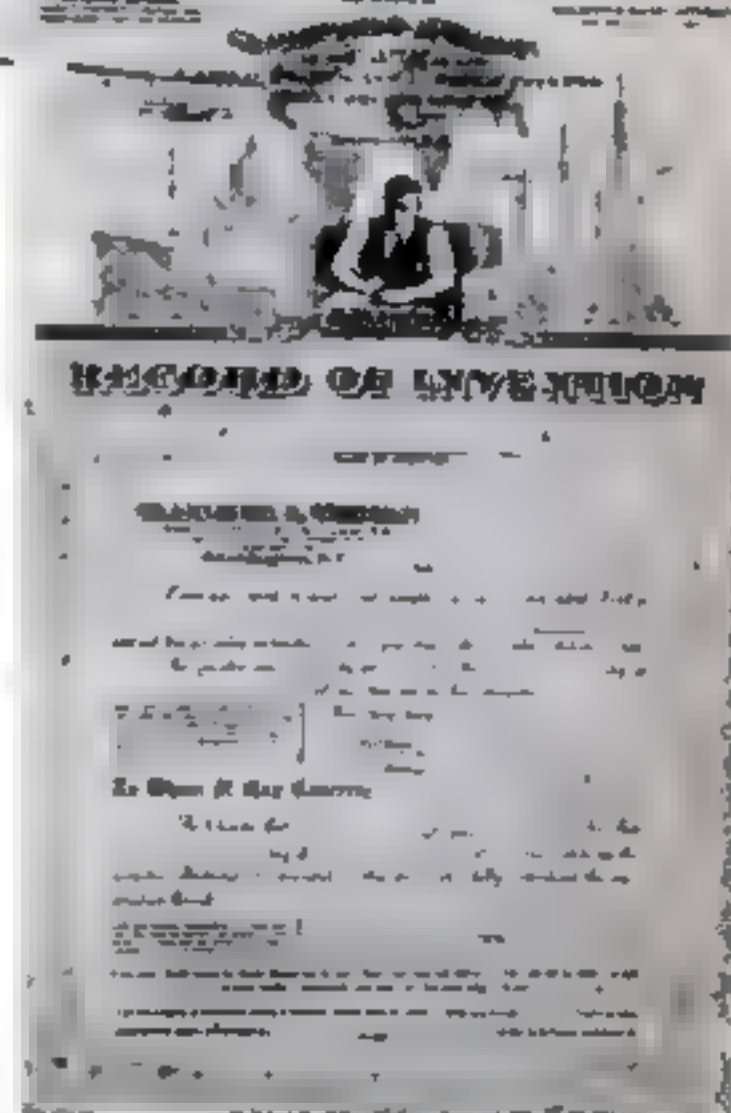
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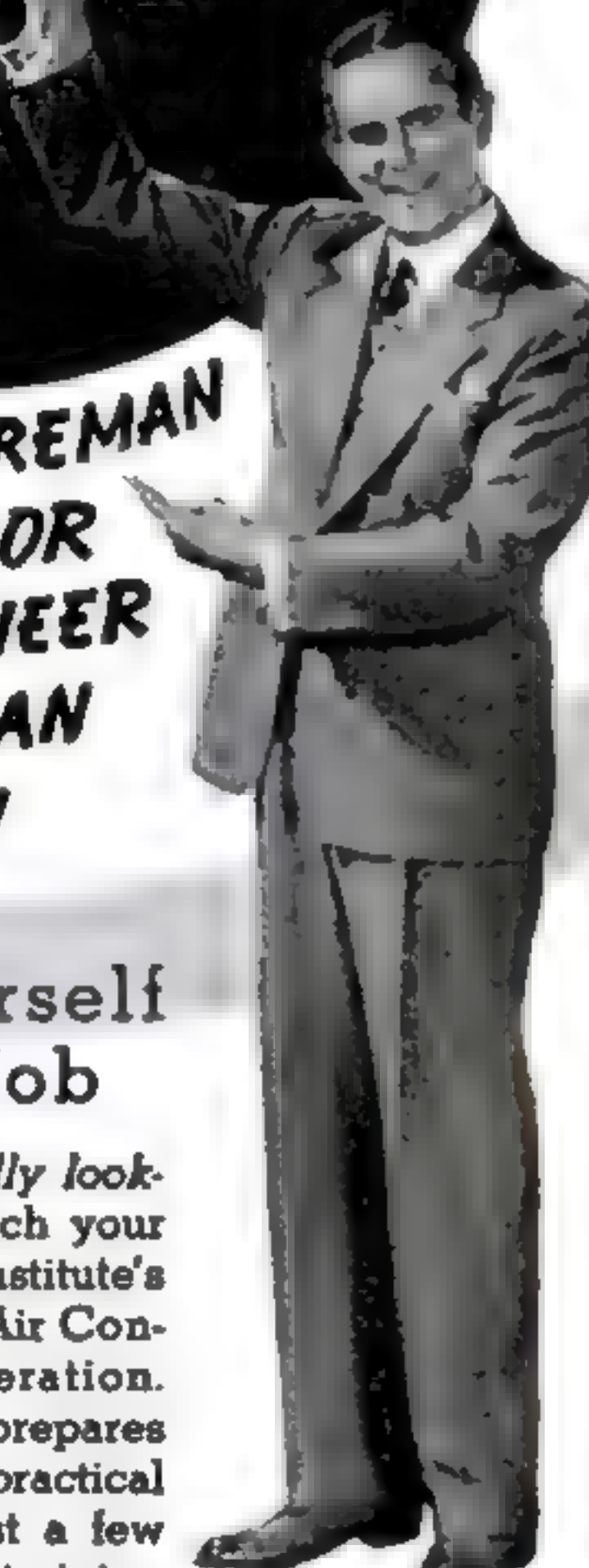
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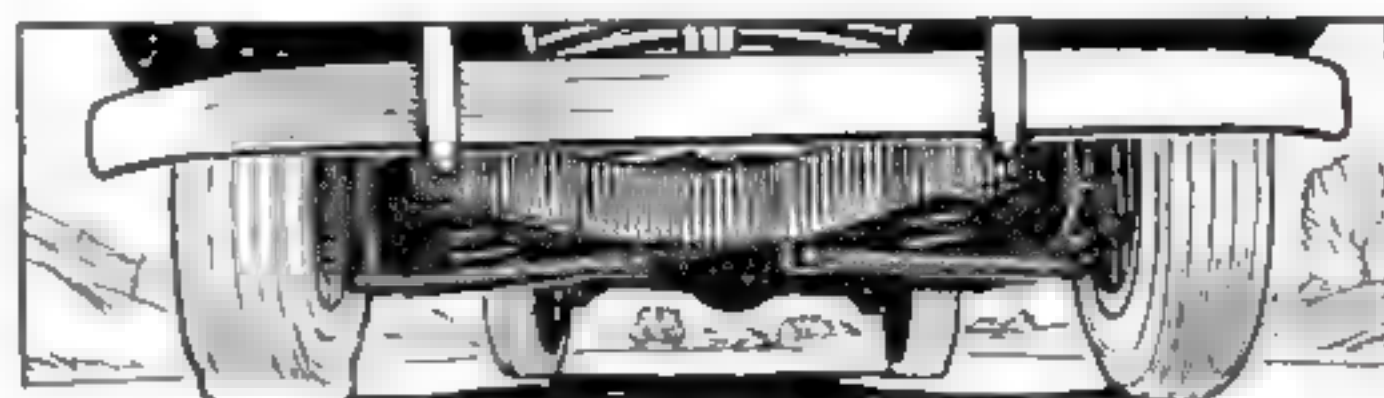
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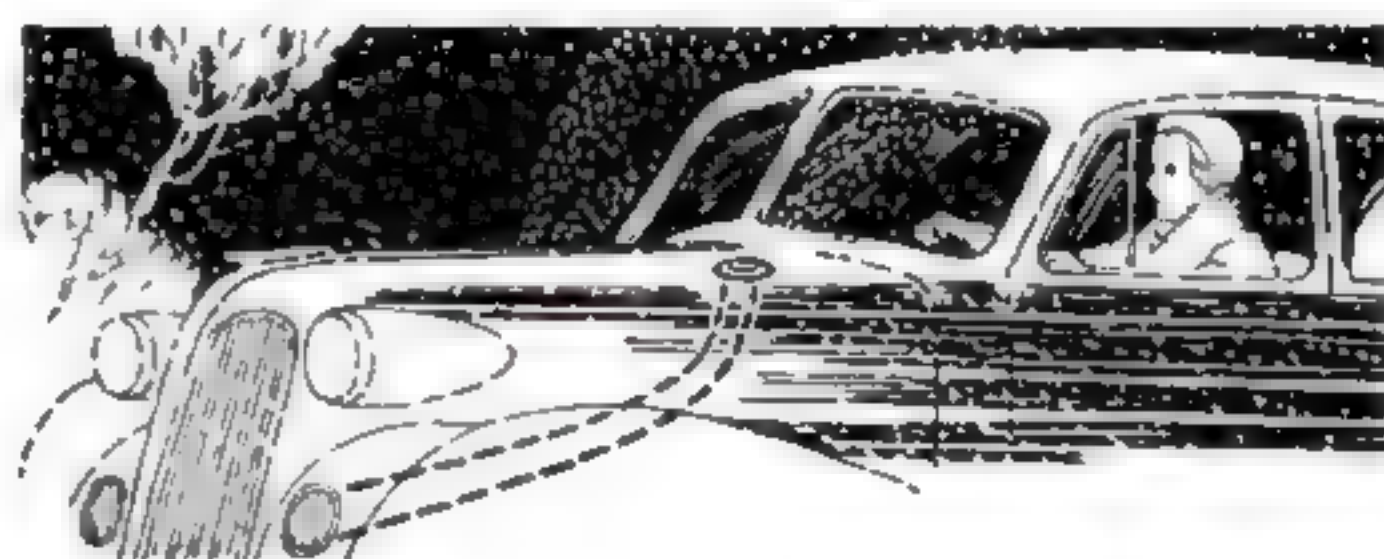
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With the Inventors

GRANDFATHER vowed that the automobile would never replace the horse and buggy. Now, grandsons are saying that the automobile is soon to be replaced by the autogiro and the helicopter. But if the activity of inventors in devising automotive improvements is any indication, the horseless carriage will still be around for some time to come, for



every month sees a new flood of automobile improvements. Noteworthy among recent inventions is a dashboard tire gauge perfected by Oscar T. Nelson, of Cleveland, Ohio. This device is designed to indicate when a car's tires are not inflated evenly at the same air pressure, a condition which can seriously affect steering and cause dangerous skidding on slippery roads. Tilting of the wheel mountings, the result of uneven pressure in opposite tires, causes a warning signal to appear on the dashboard indicator . . . ANOTHER AUTOMOBILE SAFETY DEVICE, perfected by Peter S. Riel, of Buffalo, N.Y., provides a means for keeping windshields free from driving snow or light sleet. Pipes run from inlets adjacent to the radiator grille up past the warm engine to cowl outlets in front of the windshield. When the car is in motion, blasts of warmed



air are blown upward across the windshield glass to keep it free from clogging snow and sleet . . . CONTRARY TO POPULAR OPINION, inventors can obtain patents without employing a patent attorney. However, the United States Patent Office advises against it, for, they say, "The value of patents largely depends upon the successful preparation of the specifications and claims." . . . LAST MONTH we described a silent-alarm wrist watch that pricked the wearer awake with spring-operated needles. This month there is more bad

(Continued on page 24)

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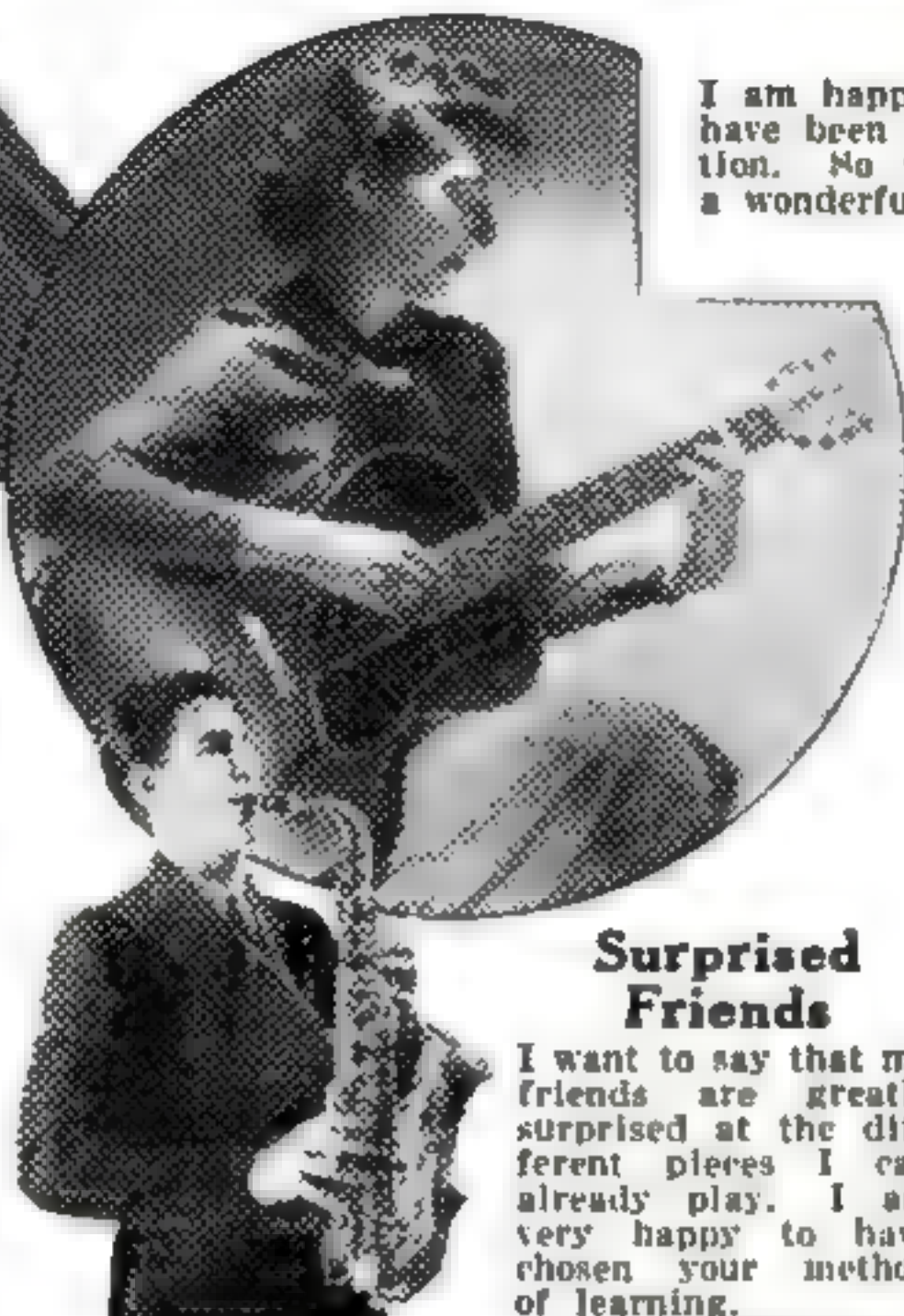


Learned Quickly at Home

I didn't dream I could actually learn to play without a teacher. Now, when I play for people they hardly believe that I learned to play so well in so short a time.
*H. C. S., Calif.

Wouldn't Take \$1000 for Course

The lessons are so simple that anyone can understand them. I have learned to play by note in a little more than a month. I wouldn't take a thousand dollars for my course.
*S. E. A., Kansas City, Mo.



Surprised Friends

I want to say that my friends are greatly surprised at the different pieces I can already play. I am very happy to have chosen your method of learning.
*B. F., Bronx, N. Y.

Plays on Radio

I am happy to tell you that for four weeks I have been on the air over our local radio station. No thanks to your institution for such a wonderful course.

*W. H. S., Alabama



Best Method by Far

Enclosed is my last examination sheet for my course in Tenor Banjo. This completes my course. I have taken lessons before under teachers, but my instructions with you were by far the best.

*A. O., Minn.

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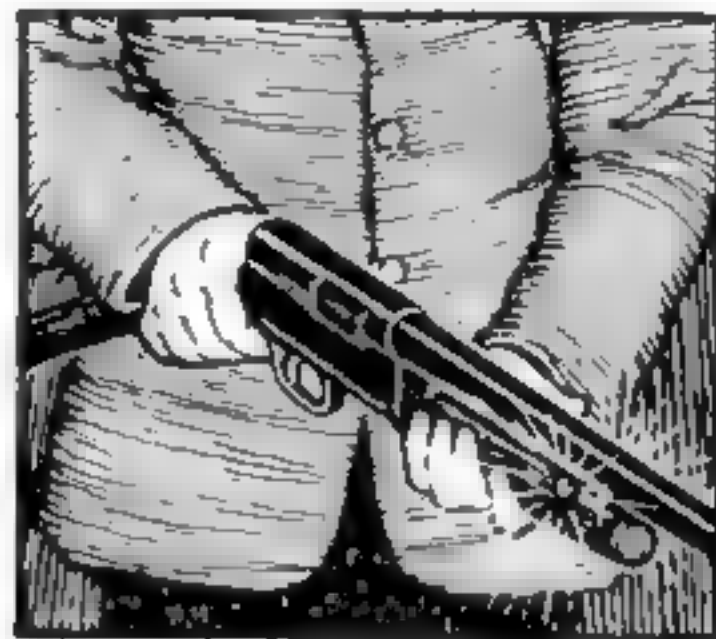
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With the Inventors

(Continued from page 22)

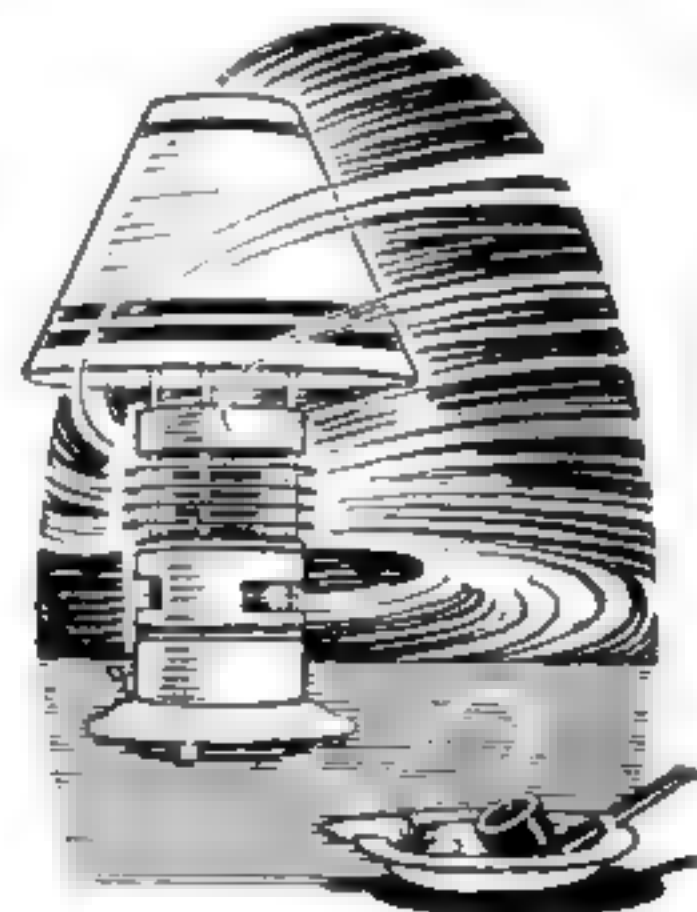
news for the hard-to-wake sleepers, for a new alarm has been devised in the form of a perforated rubber hose that is worn around the sleeper's neck like a collar. At the predetermined time, an attached alarm clock allows water to enter the hose and trickle down the wearer's neck. If an ice-cold shower bath



doesn't get you up on a cold winter morning, nothing will . . . IN THE ADIRONDACK MOUNTAINS in New York State last fall, twenty-one persons were killed and ninety-nine others injured in hunting accidents during

the deer season. A number of these tragedies can be traced to the fact that hunters forgot to snap on the safety catch to lock their guns when not in actual use. With this in mind, Charles E. Jacobs, of Minneapolis, Minn., has designed a gun attachment providing a safety light that flashes on automatically when the loaded gun is made ready to fire. Powered by a battery housed in the stock, the light bulb is placed near the muzzle. It is mounted so that it does not interfere with a hunter's aim, yet remains as a constant reminder that the safety catch is off and the gun in firing condition . . . BY A RECENT RULING, only members of the bar who practice before the Patent Office will be designated as "patent attorneys." Patent experts who are not lawyers, but who have qualified to present cases before patent officials, will be termed "registered agents." . . . TWO COMBINATION DEVICES recently perfected are

of particular interest to homemakers. One is an ingenious baby carriage that can easily be converted into a crib or infant's play yard. The second is a single unit that houses a reading lamp, an electric fan, and an air deodorizer. Devised by Don Sargent, of Portland,



Me., the fixture has an electric bulb and shade supported on a tubular base containing an electric fan that circulates air in all directions throughout a room. A deodorizing filter, also

(Continued on page 26)



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my studies in my spare time, while holding a regular job, was a godsend to me and doubtless to many others. And the lessons are so well organized and practically presented, that I would like to urge others to make use of your splendid organization.

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With the Inventors

(Continued from page 24)

in the base, removes offensive odors from the circulating air . . . MORE THAN 15,000 U.S. patents have been granted to women. Nancy Ristell, of Chicago, Ill., adds to this total by being the co-inventor of a curious combina-

tion beach hat and fan. The hat consists of a single sheet of flexible, plaited material formed into the shape of a cone which fits any size head. The plaits permit ventilation beneath the crown of the hat, and when it is not being worn, it can be



grasped at one edge and spread out to form an efficient fan to create a cooling breeze . . . THE PATENT OFFICE has no restrictions whatsoever on who may apply for a patent. It makes no difference to them whether the inventor is a three-year-old, a criminal, or even an inmate of an insane asylum. It's the invention that counts, is their motto . . . THIS MONTH'S LEADING tongue twister among patent titles is number 2,136,135: "Pseudo-Azimido-Benzene-Amino-Acyloacetic-Acid Esters." Even more advanced vocal calisthenics, however, can be obtained by pronouncing some of the acids mentioned in another recent patent: "Di-bromo-iodo-hippuric; o-iodobenzoyl-d-glutamic; o-iodobenzoyl-5-aminosalicylic." . . . MISTAKES IN TYPING will be easier to correct with an eraser that is built into a



typewriter and operated by a special key. The eraser, which is replaceable and adjustable for wear, contacts the paper on the roller, moving up and down to blot out a mistake as the key is pressed and released. This was thought up by

Frederick C. Schnabel, of Hopkins, Minn. . . . THERE IS ONLY ONE type of invention for which an inventor must furnish a working model before patent authorities will even consider his application—a perpetual-motion machine . . . A HANDY TOOL designed by Willis La Rue, of Indianapolis, Ind., is a screw driver with

(Continued on page 28)

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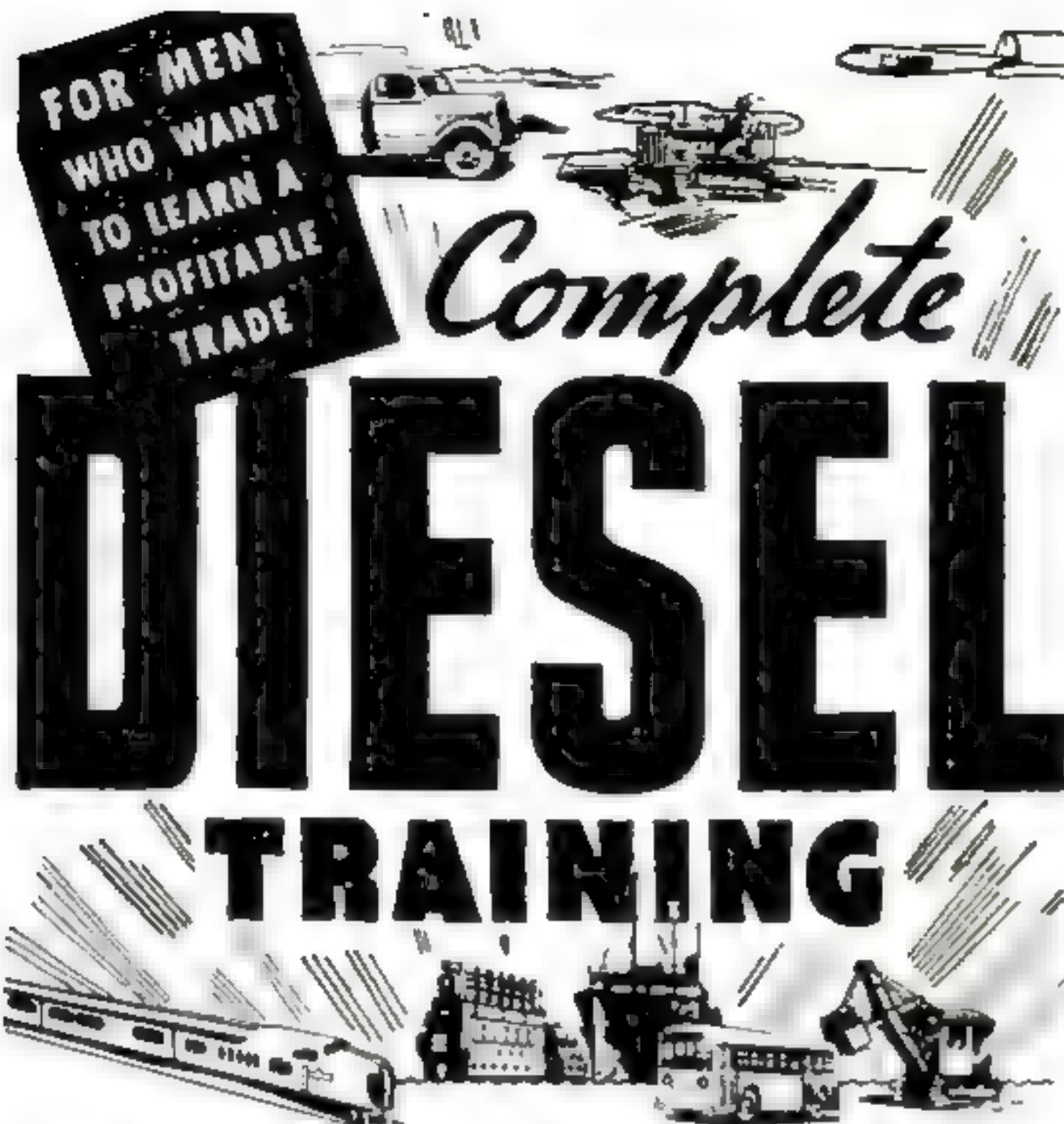
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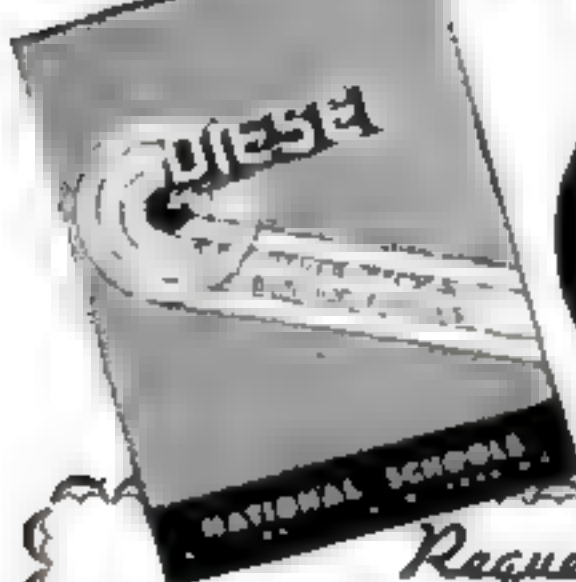
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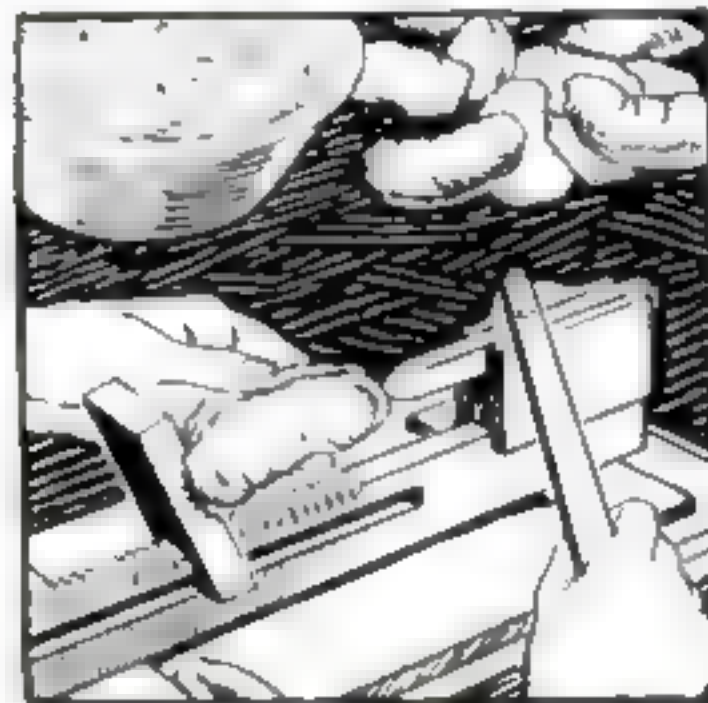
With the Inventors

(Continued from page 26)

a wrenchlike attachment that makes it easier to set screws that are hard to turn. Normally lying flat against the screw-driver handle, a metal arm slides down into a position at right angles to the screw-driver shaft so that a workman can grasp it in one hand and apply increased leverage to the business of turning a stubborn screw . . . AT LEAST FIFTY PATENTS in the United States today are said to be earning for their inventors more than \$1,000,000 a year. More than 300 patents bring in about half a million each, and from 15,000 to 20,000 earn over \$100,000 annually . . . ANYONE WHO HAS SEEN the bandages and adhesive tape swathing the fingers of a restaurant worker whose



job is opening oysters, knows how easy it is to inflict nasty cuts with a sharp oyster knife. A tool that looks like a cross between a nutcracker and a vise has been designed by Joseph E. Benson, of Cedar Rapids, Iowa,



to take over this hazardous job of splitting oysters in half. Pressing a long handle forces a knife between the shells of an oyster held against an adjustable toothed block . . . A NOVEL INVENTION BY Joseph B. Friedman, of San

Francisco, Calif., puts new life into that perennial old favorite, the ice-cream cone. This innovation provides a small cone-shaped, edible container which is inserted into the ball of ice cream resting on top of the conventional cone. Liquid flavoring sauce is poured into the small container to form a one-hand ice-cream-cone sundae . . .

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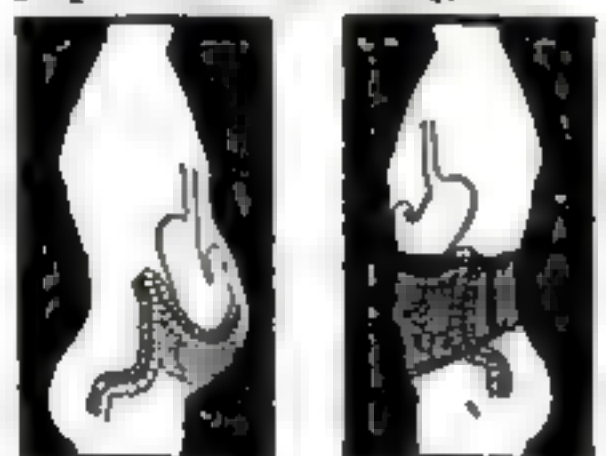
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500% PROFIT with new perfected (1938) quick-action, no flint, automatic gas lighter. Retail 25c. Sample 10c. New Method Co., Box PSG-74, Bradford, Pa.

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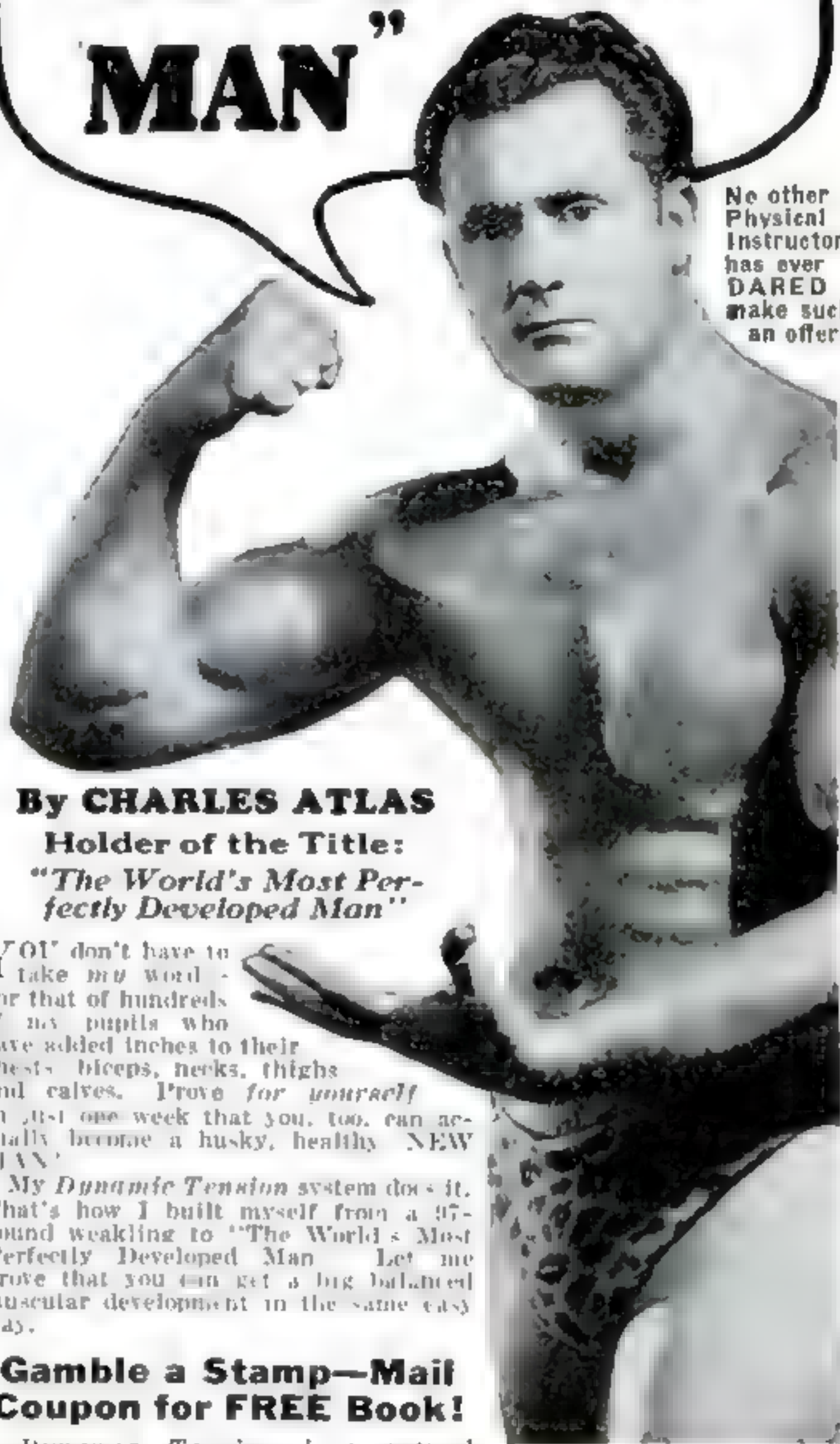
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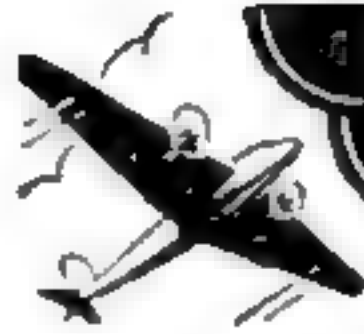
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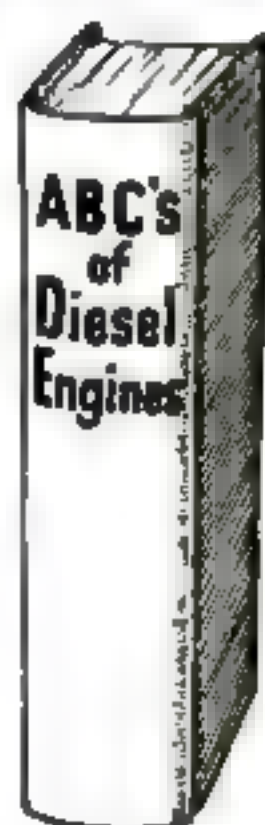
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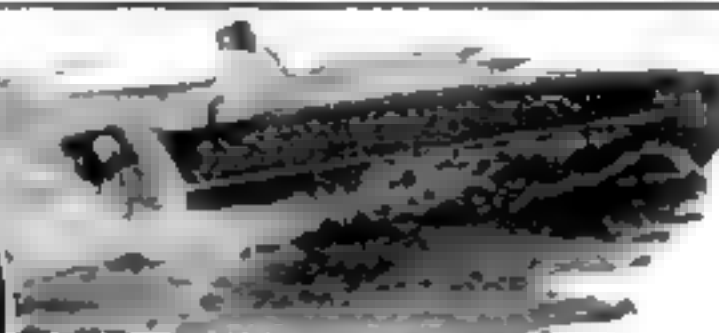
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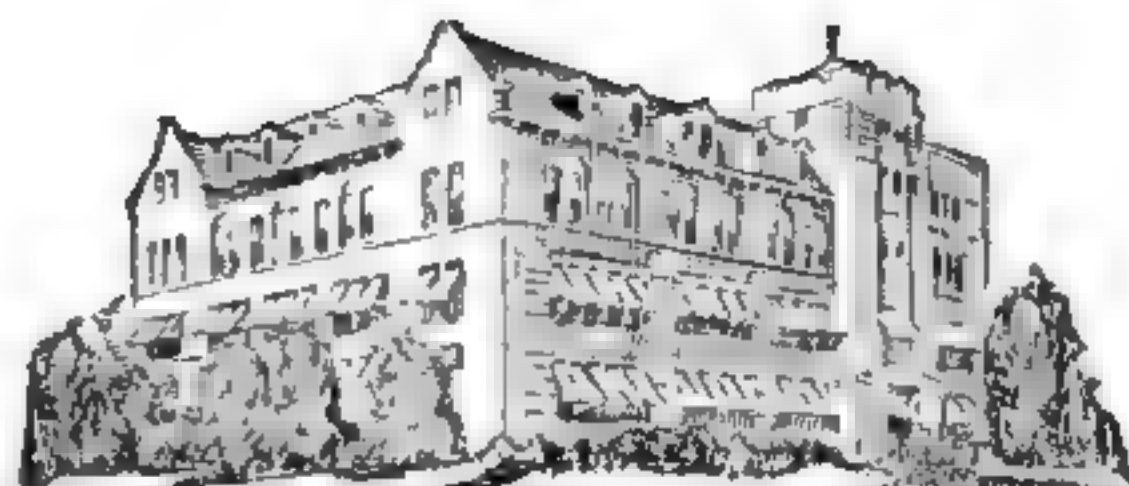


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FOR HOME OWNERS



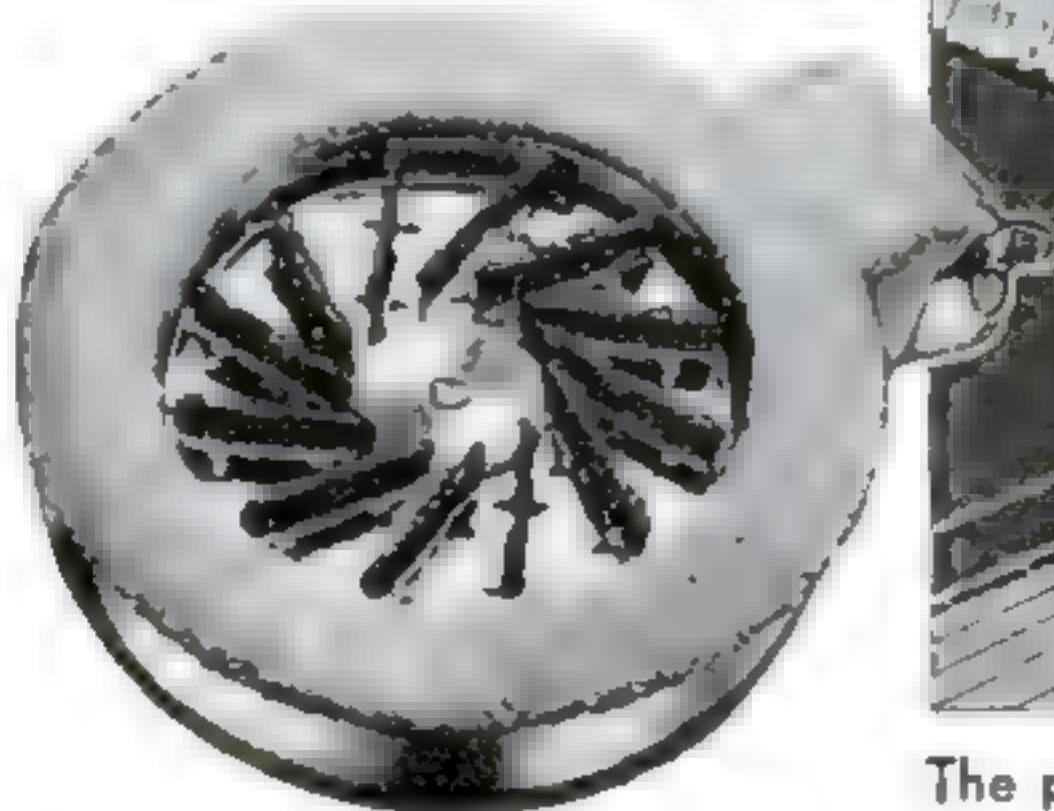
Auxiliary Oil Stove Warms Cold Kitchens

DESIGNED for kitchens that are not equipped with radiators, a handy oil-burning unit now on the market provides a plentiful supply of heat to warm the room in cold weather. Supported by fluted legs and finished in white enamel, the unit is built to the standard height and depth of conventional ranges and sinks so that it will fit in perfectly with existing kitchen equipment. The oil heater has two top burners to make it adaptable for use as a small auxiliary cooking unit if desired. When a copper water coil is added, the outfit can also be made to serve as a heater for hot water. In the photograph at the left, the oil burner is shown placed conveniently between the cooking range and the work space adjacent to the sink.

Vacuum Cleaner Furnishes Power for Floor Polisher

WAXED hardwood floors are easy to polish with an ingenious new attachment which is operated by a vacuum cleaner. The unit is attached by means of a metal cylinder and a length of flexible hose to the air outlet which normally leads to the cleaner's dust bag. When the current is switched on, the air pressure created by the cleaner motor drives an air turbine in the unit that whirls a battery of polishing brushes. The weight of the machine and the high speed of the brushes are said to produce a high, glossy polish on waxed floors with a minimum of effort on the part of the operator. A bottom view of the vacuum-cleaner floor polisher is shown at the right.

Rotating brushes in the polishing head are whirled by the air pressure from the vacuum cleaner



The polisher in use, coupled to a vacuum cleaner

IF I FAILED...WE WERE ALL DEAD MEN



LASHED TO SHROUDS
OF SINKING,
BURNING SCHOONER,
SAILORS SEE HOPE
OF RESCUE FADE

① "The dream of my life, for which I had saved since I first went to sea at twelve, had come true!" writes Capt. Hans Milton of 610 West 111th St., New York City. "I was making my first voyage as master and owner of my own vessel, the two-masted topsail schooner 'Pioneer,' when the hurricane of last September caught us 400 miles off Nantucket.

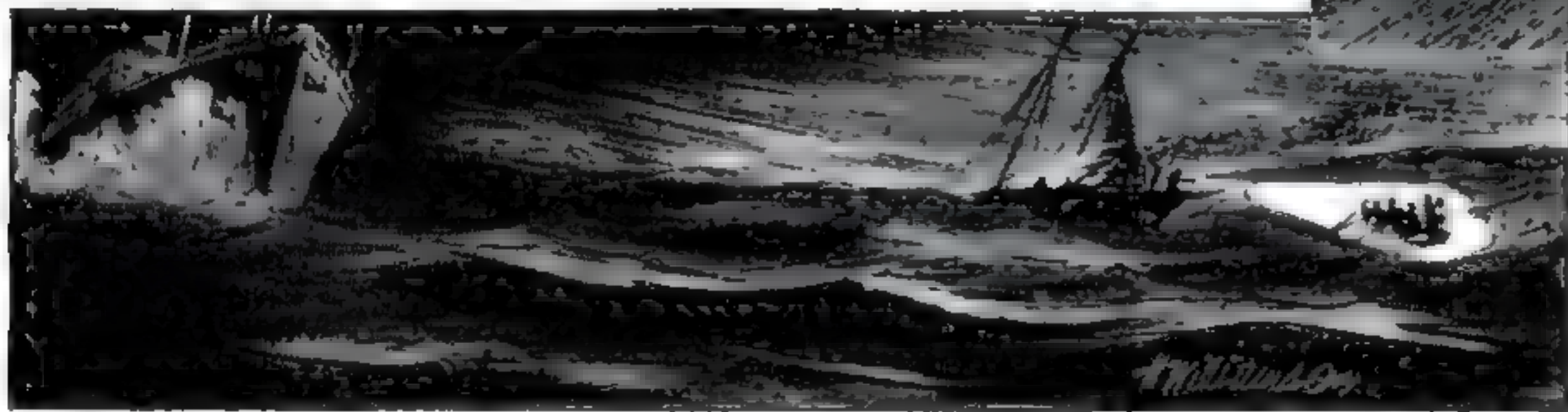


② "We were pumping to keep afloat when we passed into the windless vortex of the storm where the waves were leaping and jumping crazily and where they crashed in our companion ways and filled the ship beyond hope of saving her.

The five of us and the cat scrambled aloft for our lives. Our deck-load of lumber kept us afloat and without fresh water and with almost no food we lived, lashed to the rigging, for three endless days and nights.

③ "Once a steamer hove in sight—but failing to see our distress signals, went her way. At 3 a.m. on the fourth morning steamer lights showed momentarily over the wild sea. We rigged a huge ball of sails and blankets, soaked it with gasoline, touched it off and hoisted it aloft.

④ "But the steamer did not change her course. She thought we were fishing. The wind blew burning fragments back on the ship setting her afire in various places. I could see the stern light of the steamer going away from us. *If I couldn't stop her, we were all dead men!* I climbed to the fore-top and in desperation pulled my flashlight from my back pocket and in Morse code signalled 'Sinking... SOS... Help!'



⑤ "Slowly, I saw the ship turn! In her last hour afloat, all of us and the cat were saved from the sinking, burning 'Pioneer' by those fine seamen of the United States Liner 'American Banker' and by the power of two tiny 'Eveready' fresh DATED batteries that stood by us in the blackest hour of our lives!

(Signed) *Captain Hans Milton*

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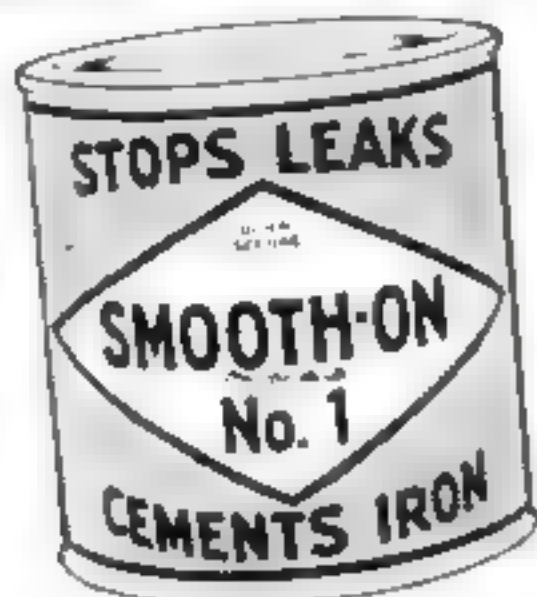


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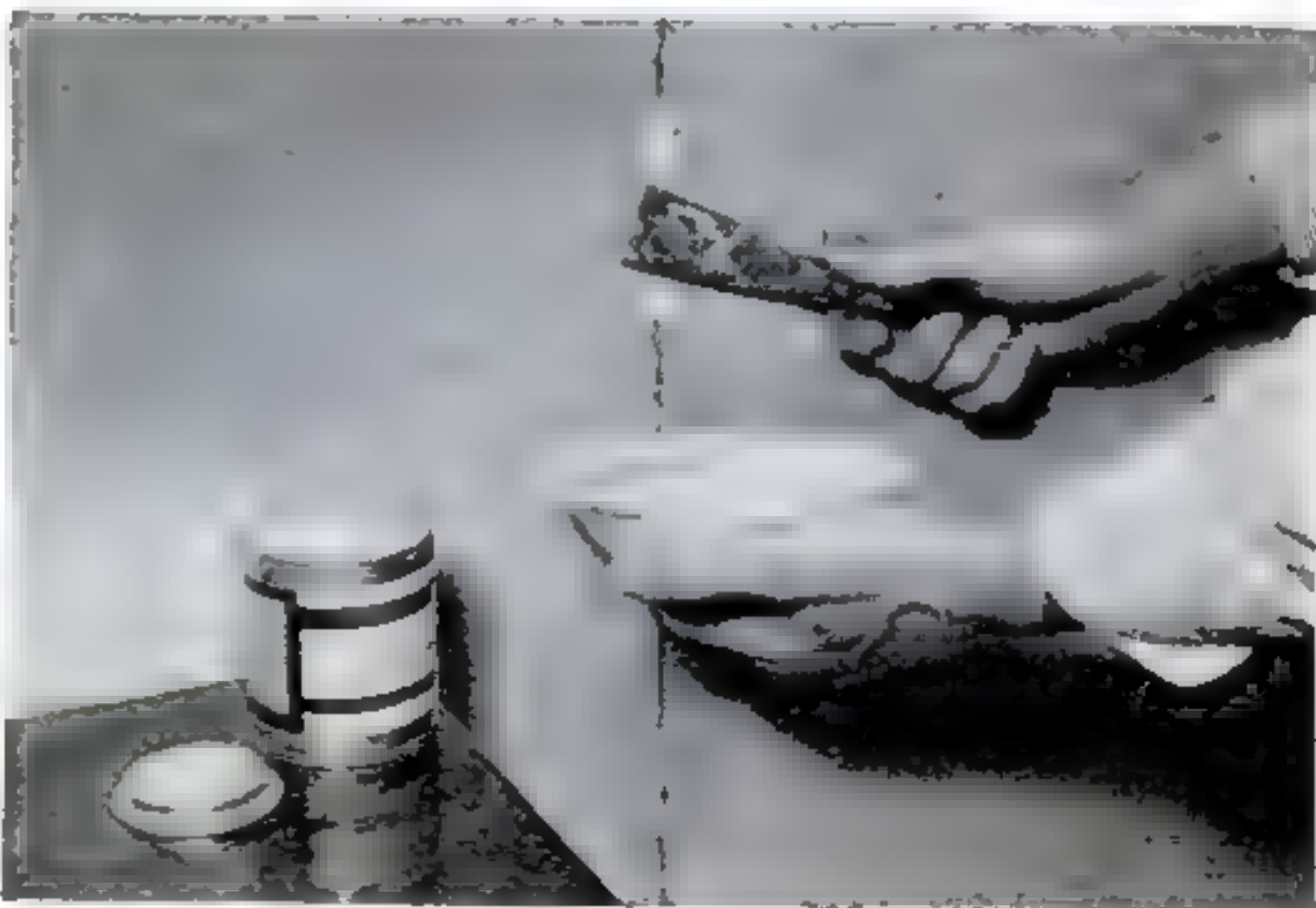
Attached to a fuse box, the handy kit shown in use below, makes sure that candles and matches are handy when a fuse blows



CANDLES and matches for emergency use when a blown fuse cuts off the house current are contained in the handy metal case which is attached at one side of a fuse box, as shown above.

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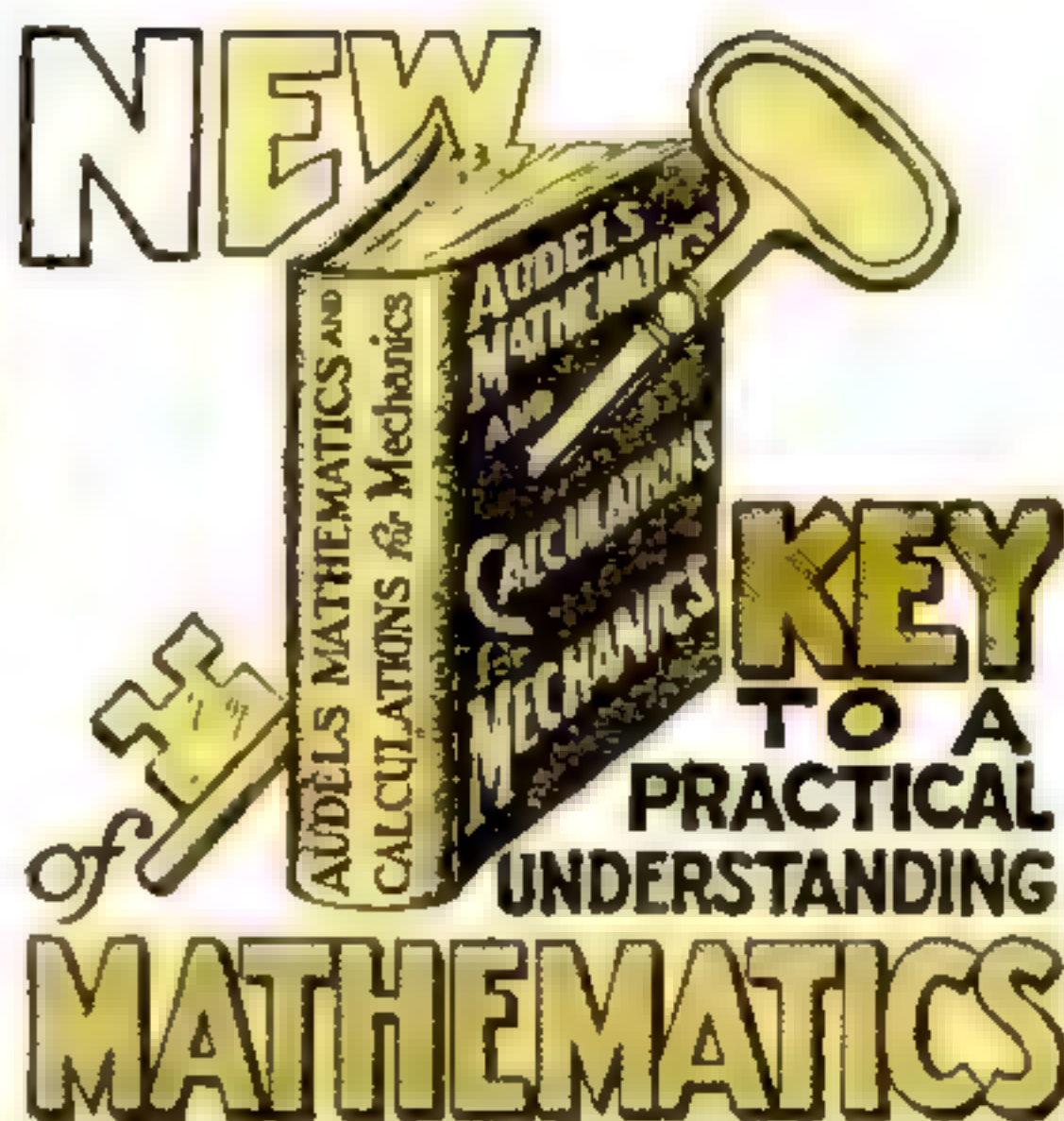
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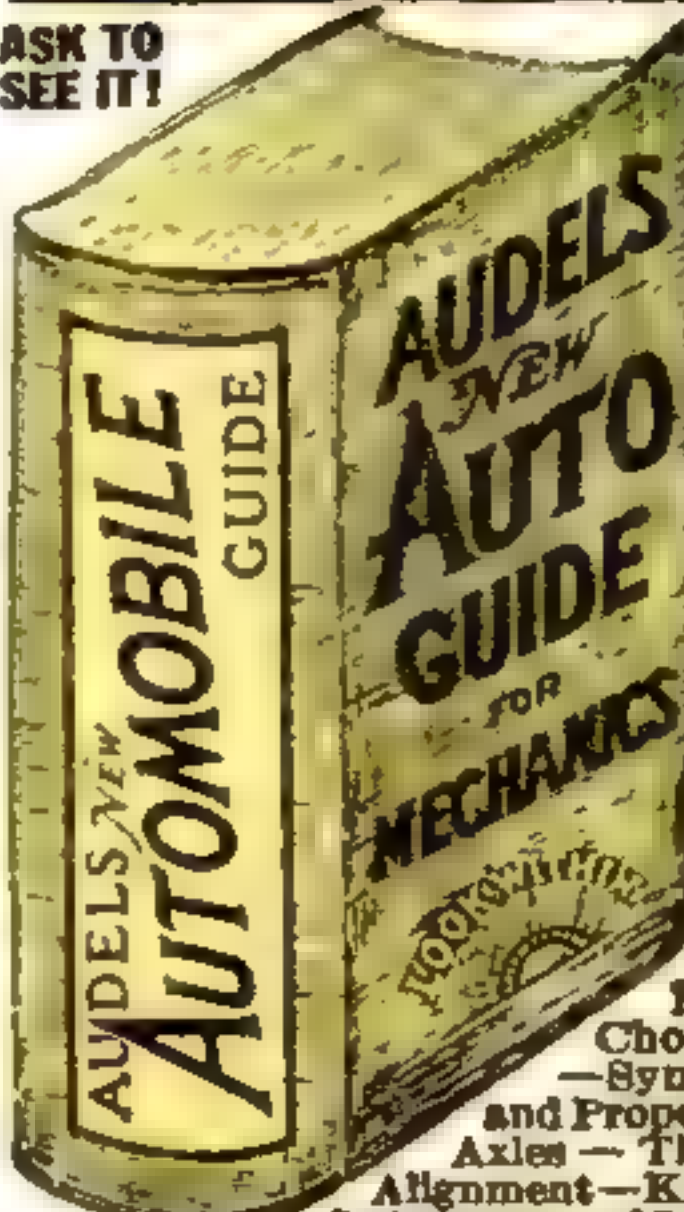


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 —R.A.F., Waterloo, Iowa.

A.—THE only satisfactory way to restore the chest-top finish is to remove the entire finish and revarnish. If you don't care to go to this trouble, however, the spot can be darkened by the judicious application of varnish stain with a small brush. When thoroughly dry, this should be rubbed down with pumice stone and water or oil. But even the most skillful work will only make the spot less conspicuous. For temporary repair, try rubbing the spot with a wax crayon and then polish with a soft cloth until a luster is produced.

Remedy for Sweating Tank

G.T.T., CHICAGO, ILL. Excessively cold water in a toilet tank will cause it to sweat on warm, humid days. Running the cold-water line close to the hot-water pipe will take the chill from the water and remedy the trouble. Installing a few extra lengths of pipe in the basement, so that the water may circulate and thus warm up a trifle, will also help matters.

Applying Paint to Brick

C.L.K., OMAHA, NEB. Bricks are difficult to paint because they are so porous. The first coat, therefore, should be liberally thinned with pure linseed oil—as much as one gallon of oil to each gallon of ready-mixed paint. Apply freely and let dry for at least a week. The second coat should be thinned half as much as the first, and the third coat applied undiluted as it comes from the can.

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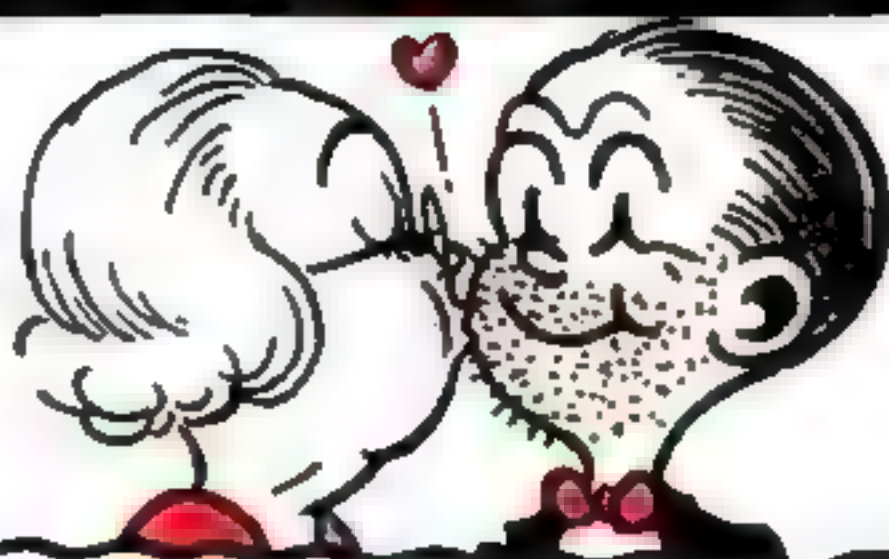
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Questions from Home Owners

(Continued from page 54)

Cleaning Brass and Copper

Q.—I HAVE an old brass ship's lantern and a copper kettle, both of which have become blackened. I have had little success in cleaning them with conventional brass polish. What can you advise? —F. D. H., Hillsdale, N. Y.

A.—A STRONG cleaning solution for brass and copper can be prepared with one part of nitric acid and one-half part of sulphuric acid. Mix this carefully in a stone jar, and dip the objects into it. Remember, acids are injurious to skin and clothing. Then wash them thoroughly in clear water and dry them in sawdust. Be sure to remove any small parts that are not made of brass or copper before trying this cleaning treatment.

Shellac Under Spar Varnish

J. S., STROMBURG, NEB. The use of shellac under a coating of spar varnish, although often practiced, is a very serious mistake, and such a finish is almost certain to be ruined when exposed to the weather.

Painting Crumbly Plaster

J. W. H., WATAGA, ILL. When painting a plaster wall whose surface tends to crumble, all plaster powder should first be removed with a painter's duster or large-bristle brush, taking care not to mar the surface. Patch all large defects, and then apply a coat of varnish size and follow with a priming coat of flat wall paint, or a mixture of half wall paint and half size. Finish with two or three coats of paint, applied lightly.


Mildewed Upholstery

K. C. W., MIAMI, FLA. When upholstery develops mildew, brush the fabric thoroughly and then sponge with a soap solution containing a small amount of ammonia.

Sweating Water Pipes

E. H., CHICAGO, ILL. The only sure cure for water pipes that sweat and drip on the outside under certain atmospheric conditions is to insulate the pipe from the air. A length of old clothesline, coiled around the pipe, will do the trick.

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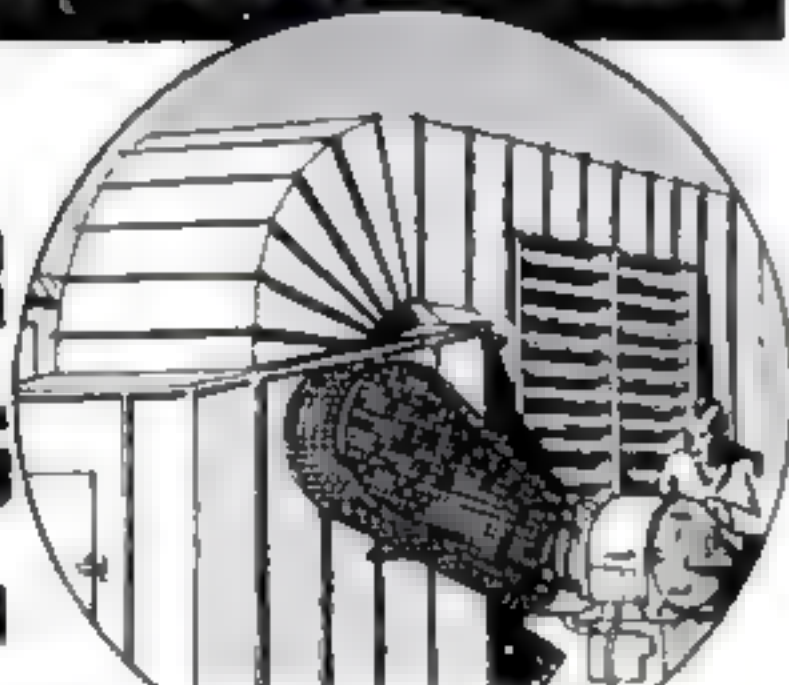
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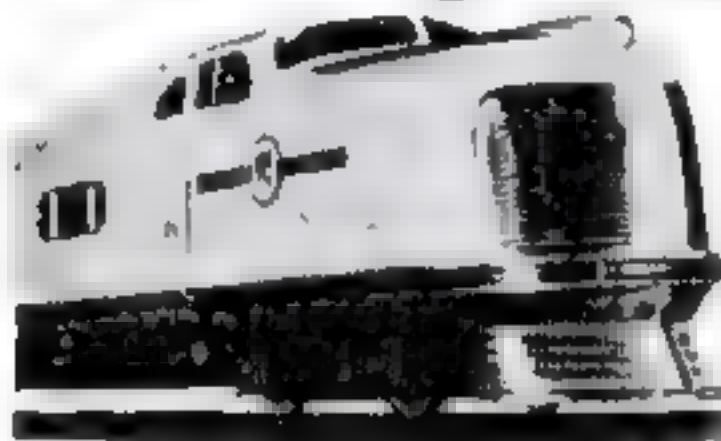
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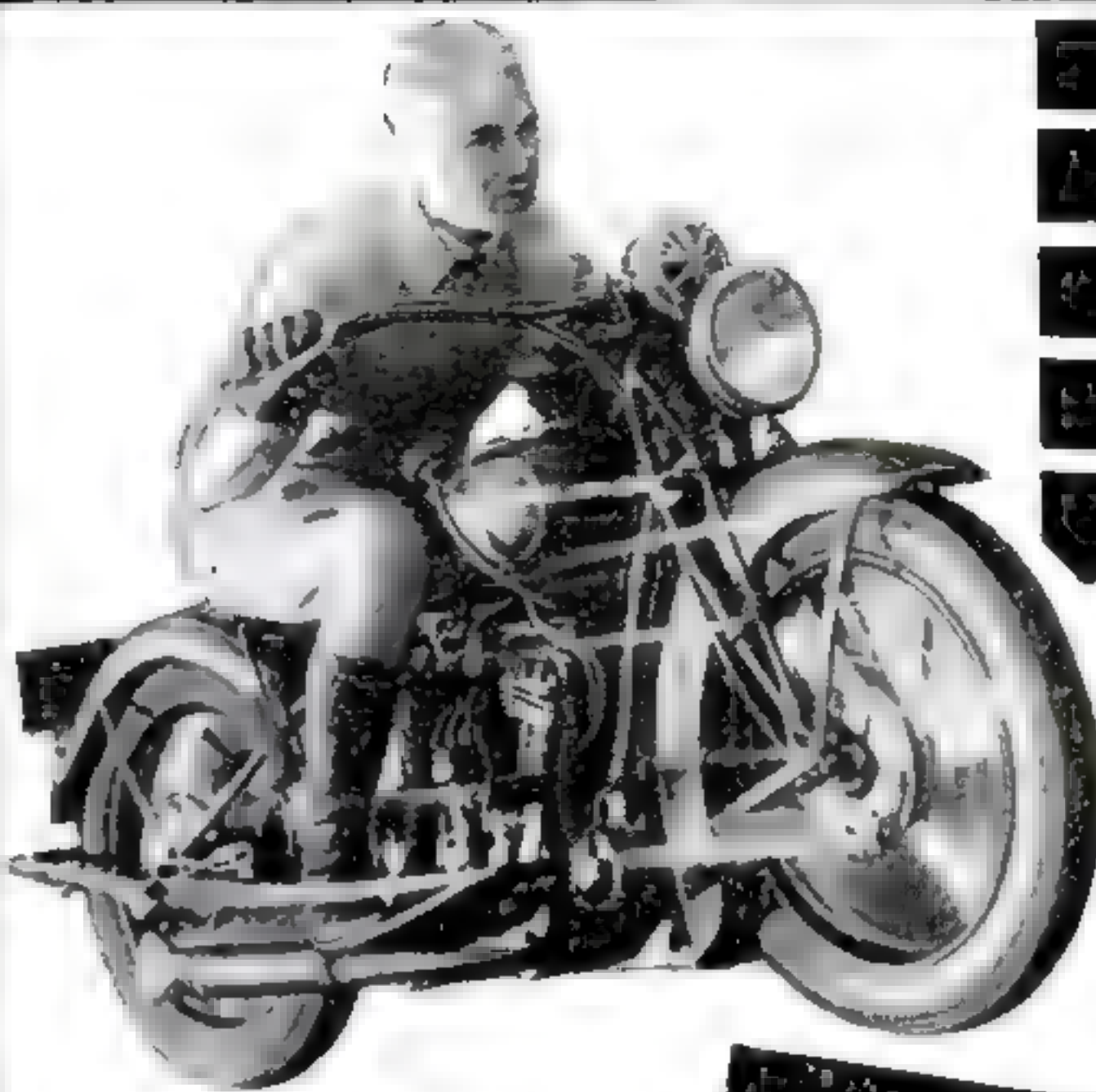
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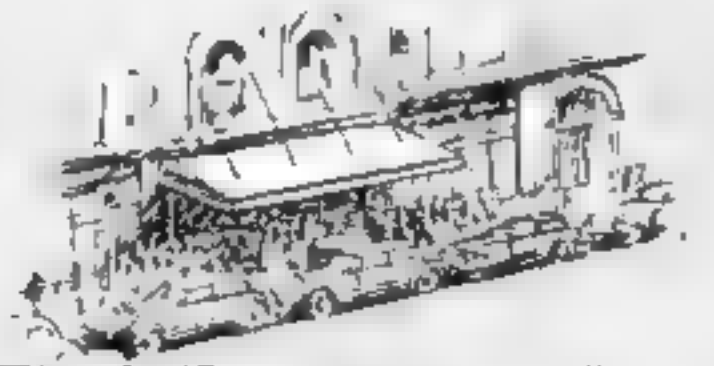
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AT THE METROPOLITAN
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THIS SEEMS LIKE OLD TIMES TO ME
CHUBBINS. YOUR MOTHER AND I ALWAYS
TOOK IN THE OPERA ON OUR TRIPS TO
NEW YORK.



THERE'S OUR FRIEND, THE MUSIC
CRITIC—WE'RE SITTING WITH HIM,
YOU KNOW.

HELLO,
JUDGE.



YOU CAN WRITE HOME THAT YOU SAT
IN THE FAMOUS 'DIAMOND HORSESHOE'

AND WHAT
A GRAND
EXPERIENCE
IT IS!



I DIDN'T QUITE HEAR WHAT
YOU WHISPERED—SOMETHING
ABOUT THAT CHARACTER BEING
SO HAPPY AND CONTENTED
SMOKING HIS PIPE.

YES, JUDGE, I SAID
YOU OR I COULD PLAY
THAT PART TO PERFECTION,
ENJOYING PRINCE ALBERT
AS WE DO.



THERE'S NO OTHER
TOBACCO LIKE PRINCE
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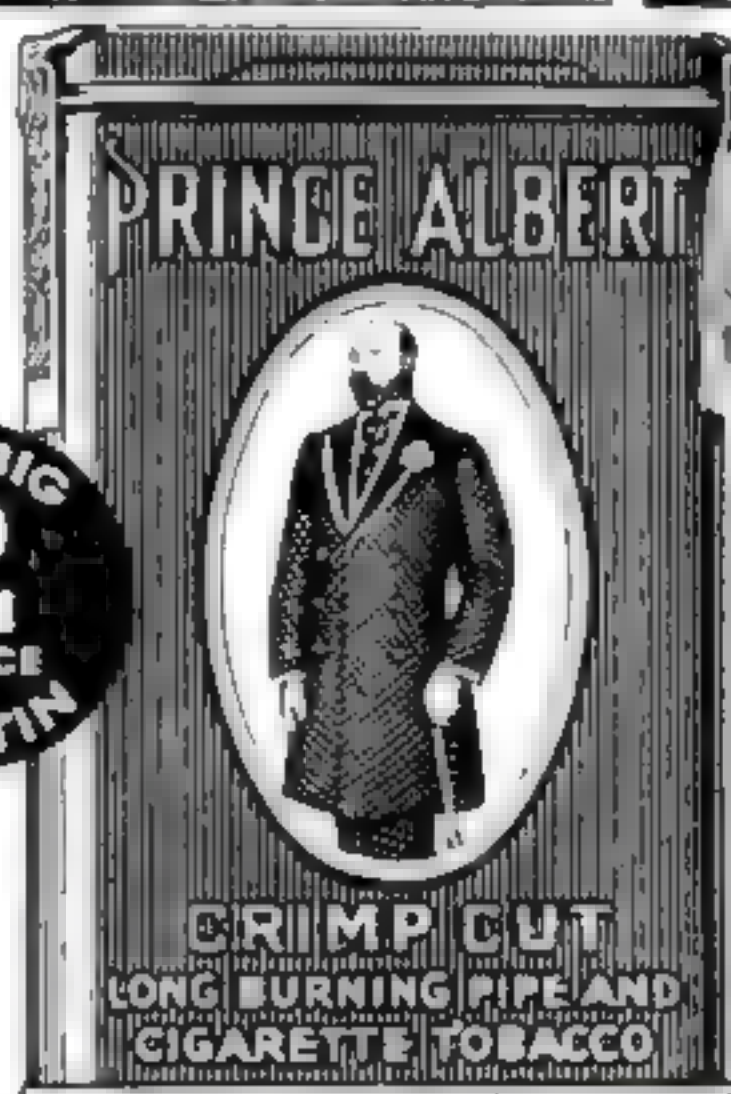
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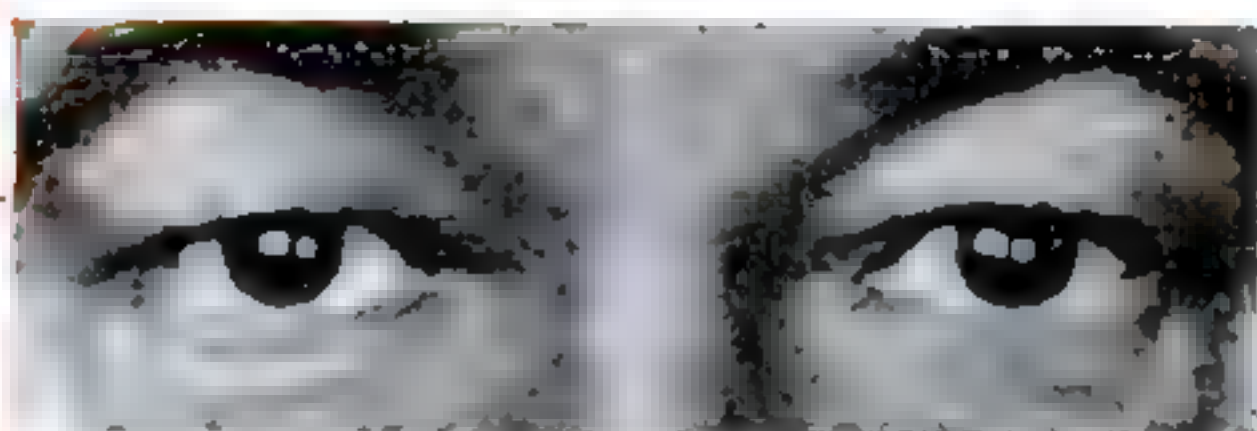
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POPULAR SCIENCE MONTHLY

RAYMOND J. BROWN, Editor . . . FEBRUARY, 1939



Is Your Eye *an Electric Compass?*



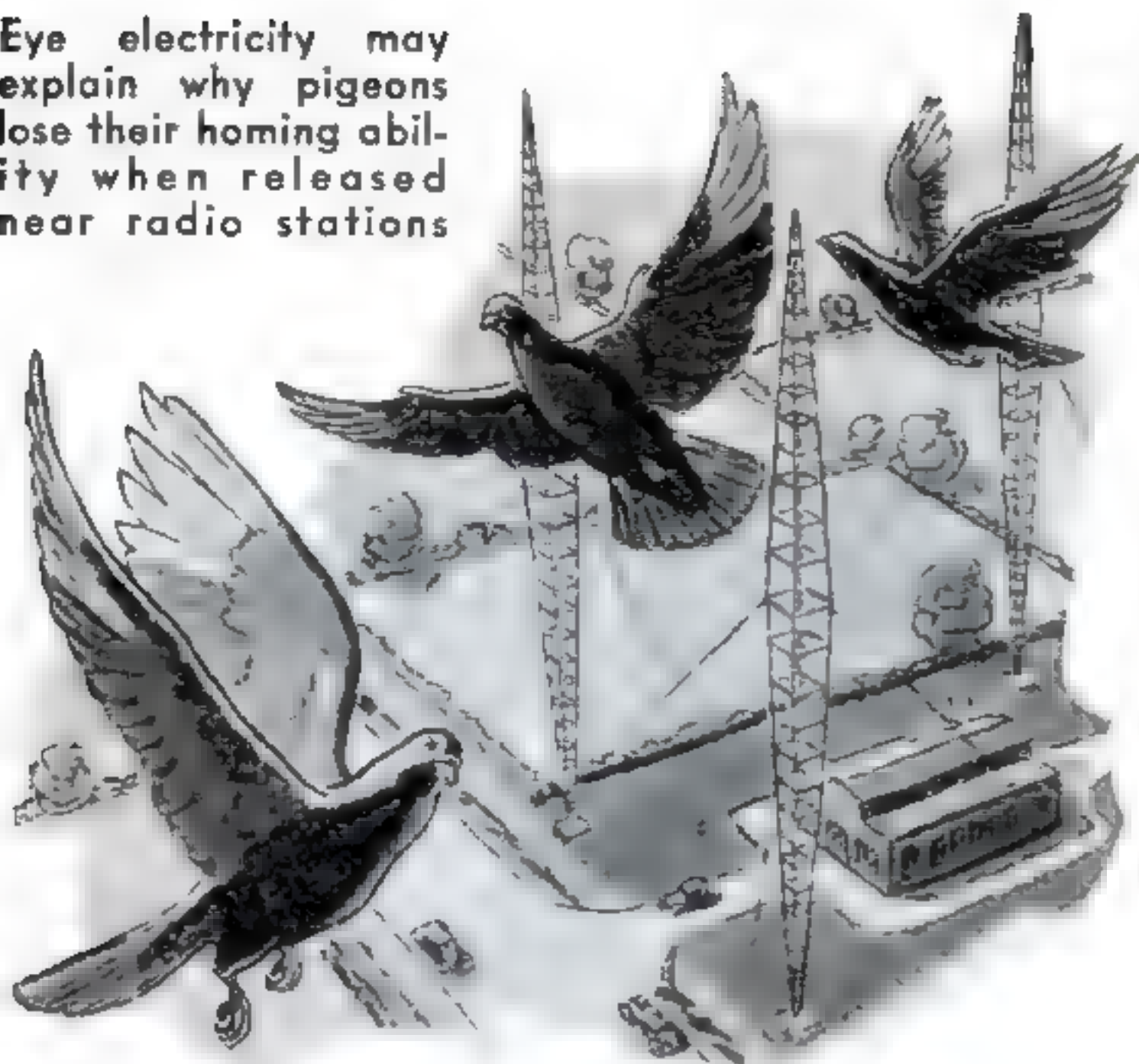
Brain-wave tests, like the experiment above, show that our brains produce electricity. Similar research now proves that our eyes are tiny electric batteries

By
**John E.
Lodge**

TINY disks of metal foil, attached to delicate wires in a Yale University laboratory, have just given science a new clew to an ancient riddle. A few weeks ago, Dr. Walter R. Miles, Yale psychologist, reported to the National Academy of Sciences the remarkable discovery that eyes, literally, are "living batteries" charged with negative and positive electricity. Out of his researches may come the final solution of that age-old mystery of the migrating birds, how these winged legions can set their courses unerringly through darkness and fog and across vast stretches of the sea. Experimenting in his New Haven labora-

**AMAZING TESTS IN THE LABORATORY GIVE A NEW CLEW
TO THE AGE-OLD MYSTERY OF THE MIGRATIONS OF BIRDS**

Eye electricity may explain why pigeons lose their homing ability when released near radio stations



tory, Dr. Miles taped the foil disks to the skin of subjects, just above and below their eyes, and attached the wires to powerful amplifiers and delicate electricity-measuring instruments. These devices revealed that the average eye is charged at approximately two thousandths of a volt of electricity; that this voltage remains virtually constant; that it is not affected by darkness or light; and that the lens of the eye represents the positive pole of the battery and the retina, at the back of the eyeball, the negative pole.

For years, scientists have known that various functions of the body, such as breathing, winking, and chewing, are accompanied by minute flows of electric current. A whole new field of research has grown up around the discovery that char-

acteristic pulsations of electricity, called brain waves, arise in the gray matter (P.S.M., May '36, p. 11). It remained for Dr. Miles, however, to reveal the constant electrical character of the eye, a discovery which provides science with a new approach to the problem of how birds find their way along the uncharted highways of the sky.

This perennial puzzle of ornithology has occupied the minds of naturalists since the days of the Greek philosopher Aristotle. A host of varied theories have been advanced in explanation. A few scientists have maintained that the answer lies in some inexplicable sixth sense. Others have held that the winged wanderers fly from landmark to landmark, guiding themselves by sight alone. Still others have suggested that directional winds high in the atmosphere form airy guideposts that direct the migrants unerringly on their long journeys through the sky to distant lands.

Each hypothesis has its train of question marks. If migrating birds depend upon landmarks on the ground, for example, how does

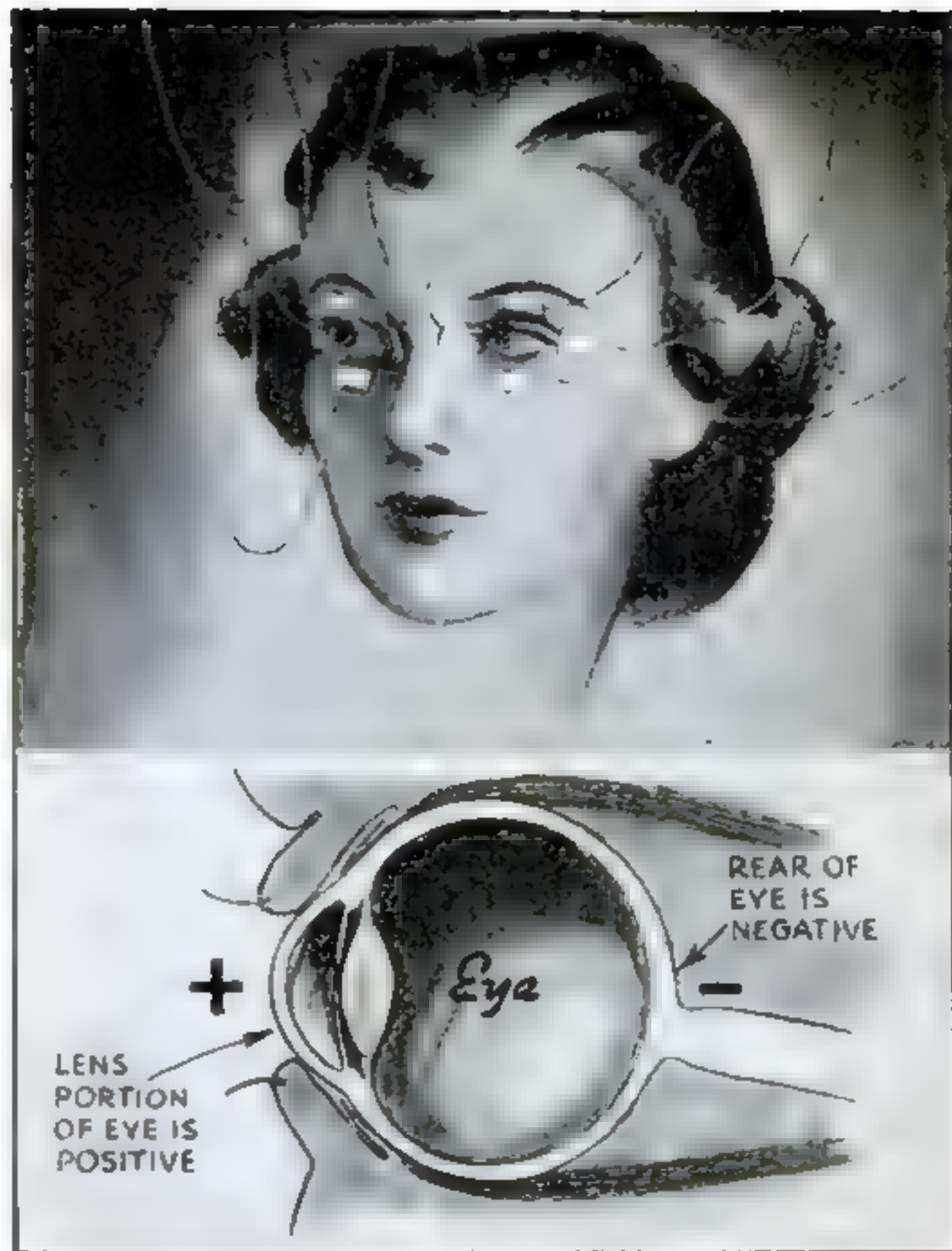


How Dr. Miles measures the electricity in the eye. Instruments connected to the eyes through tin-foil electrodes record the current as the subject watches rows of flashing lights

the tiny humming bird, no larger than your thumb, set its course over 500 miles of rolling water in a single flight across the Gulf of Mexico? Or, how does the golden plover wing its way 2,400 miles from Nova Scotia to the Argentine, flying all the way over the sea, out of sight of land? If birds guide themselves by means of high air currents, how can we explain the uncanny skill of the smaller migrants which fly low and yet return year after year to the very garden or orchard in which they nested before?

About a decade ago, a number of naturalists, including John T. Nichols, of the American Museum of Natural History in New York City, advanced the startling theory that birds may fly by "radio compass." That is, nature may have endowed these creatures with some delicate sense organ which enables them to steer by the lines of magnetic force flowing around the earth, just as an airman keeps to his course by following a radio beam.

This theory would explain why homing pigeons circle around and around at the start of a distance flight. They would be getting the "feel" of the earth's magnetic lines. Among the many things suggested that the birds may use for their guidance, these lines of magnetic force remain most constant, running in a north and south direction, flowing eternally between the two magnetic poles.



The eye as a "living battery." Measurements made with tin-foil electrodes as indicated show the lens to be the positive pole, the retina the negative



Dr. Miles at work in his laboratory. His discovery that our eyes are electric batteries gives a clue to the mystery of bird migrations

In recent years, the hypothesis has been strengthened by interesting tests carried out in different parts of the world. At Youngstown, Ohio, for instance, homing pigeons were released close to the antenna of a powerful radio station. When the station was off the air, the birds circled for a few seconds and then headed away in the direction of home. But, when the station was in action, the pigeons became confused. They fluttered in circles for nearly half an hour. Finally, they scattered in all directions, unable to decide which was the right way to go. Similar results were obtained by other experiments in France.

What had happened to the birds? What had upset their mysterious ability to find their way through the air? The most likely explanation seems to be that the bombardment of radio waves built up electric charges on their bodies which neutralized the tiny voltages within the sense organ which forms the compass of the birds.

Just where this organ is located, its nature, and how it functions, have been blank spots in our knowledge, heretofore. Now, the discovery by Dr. Miles suggests strongly that the eyes hold the key to the mystery.

Safety School Bus Has Cylindrical Body



DESIGNED to afford the maximum of safety for its young passengers, a school bus invented by J. Kirk Farris, of Sentinel, Okla., has a body made entirely of metal shaped into cylindrical form. In case of a major accident in which the vehicle tipped over, the inventor claims, the impact would be considerably lessened by the fact that the circular truck body would tend to roll instead of landing flat on the ground. The circular school bus is pictured at the left.

The rounded body is designed to allow the bus to roll over without crushing



New Electric Inhalator

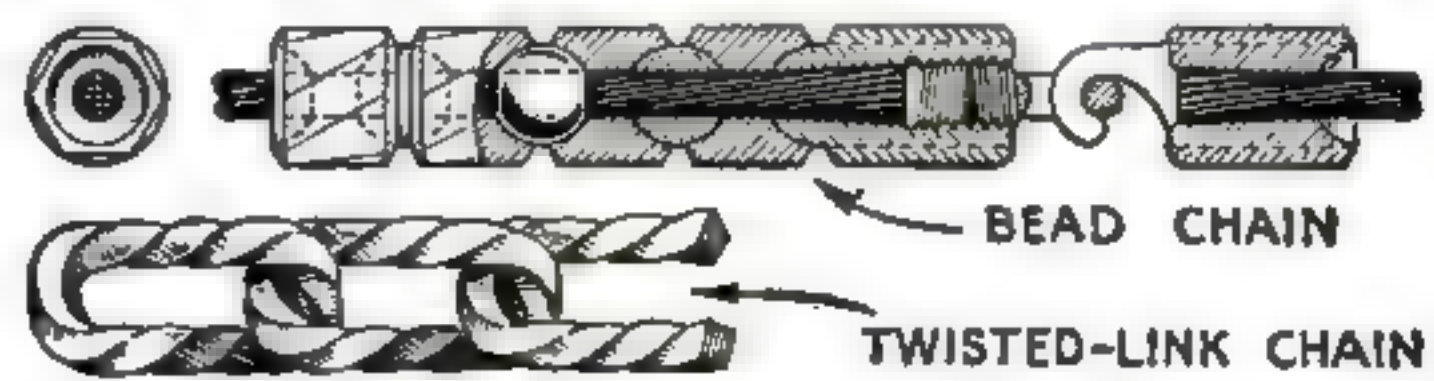
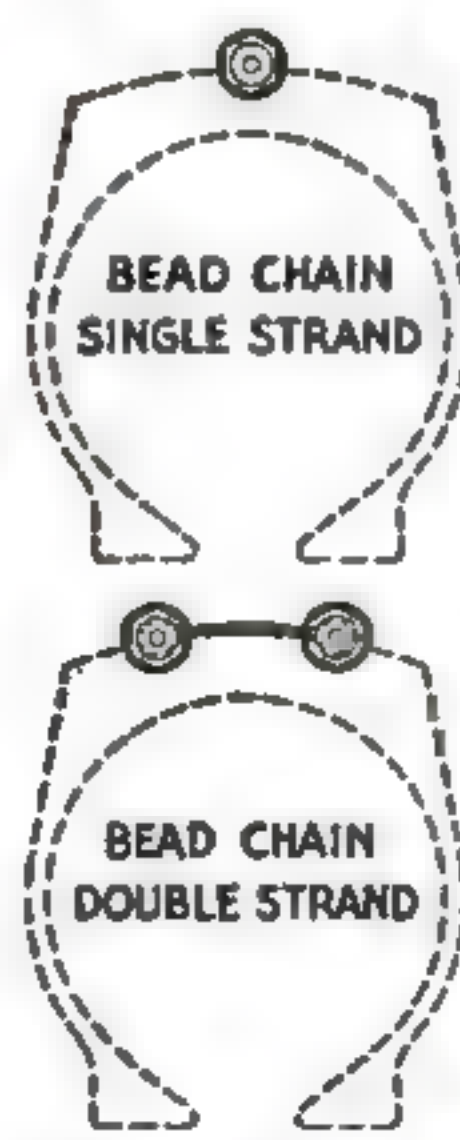
HEAD colds and other respiratory ailments are treated with a new electric inhalator that can be plugged into any convenient outlet. The molded unit houses a heating element which vaporizes medicated tablets or liquids for inhalation.

Blow-out Danger Lessened

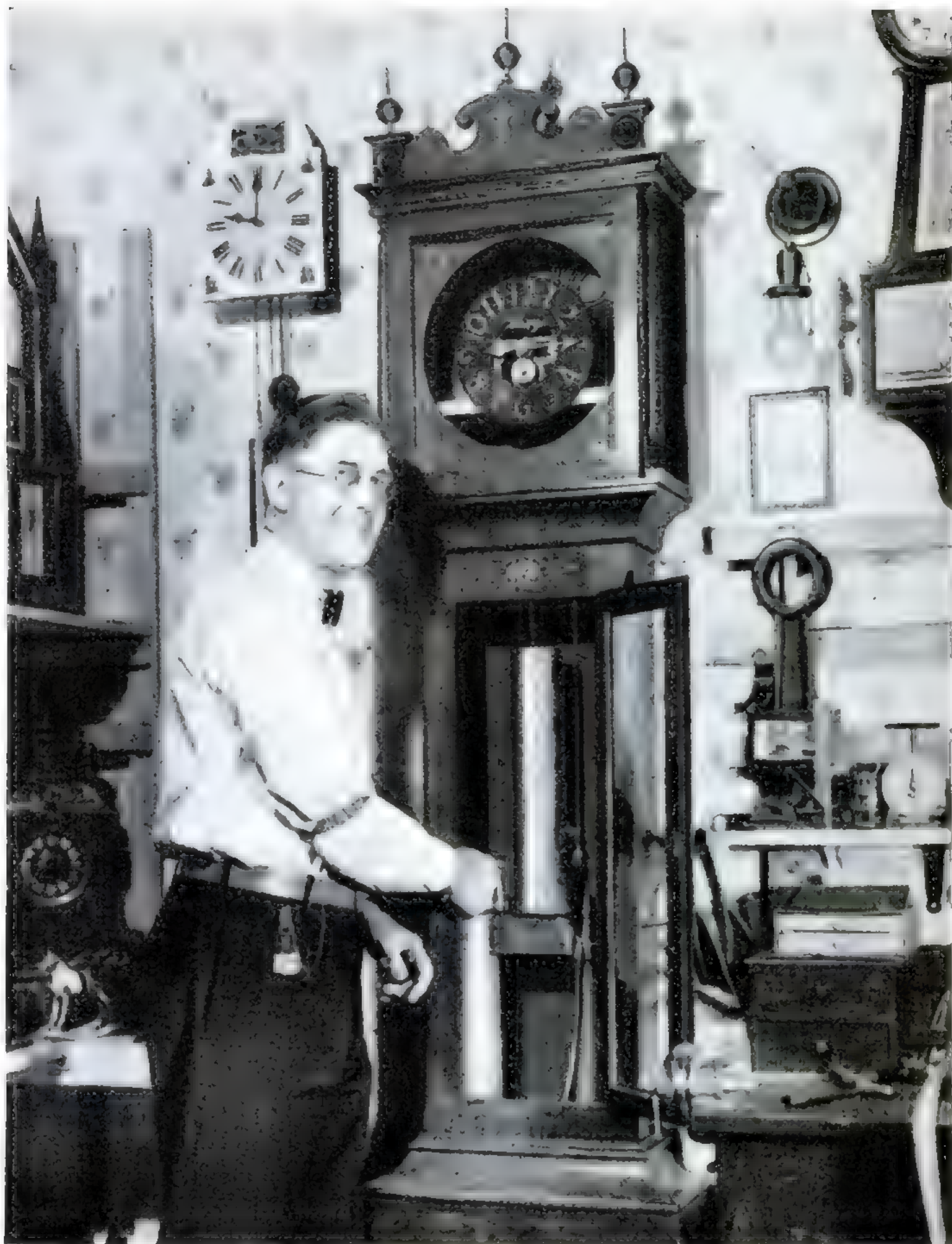
TO DECREASE the danger when a front tire of an automobile blows out, a locking device devised by Robert Lee, of Savannah, Ga., goes into operation when the blowout lowers the wheel, preventing the steering gear from turning suddenly in either direction.

Chains Fit into Tires

HIGH antiskid protection is claimed for a new automobile tire having grooves that accommodate metal chains, as shown below. The skid-resistant tires are the joint invention of Morgan S. Elmer, and of Ethan I. Dodds, a Pennsylvanian who has 400 patents and about 1,800 inventions to his credit.



In either single or double strands, and of several types, the chains are set in grooves in the tire



Clock Hobby Takes All His Spare Time

EVERY hour on the hour, bedlam breaks loose in the Cleveland, Ohio, home of Charles S. Mills, as 125 old and valuable clocks begin to strike. For years, Mills has spent all his spare time hunting old timepieces and putting them into working order. Above, the clock hobbyist is shown adjusting one of his prizes, a clock that runs by water.

IN A British court, a few months ago, a prisoner stood charged with housebreaking. His fingerprints had been found at the scene of the burglary, and the case seemed air-tight. But he pleaded not guilty and offered a novel defense. Whoever committed the crime, he said, might have "planted" his fingerprints there. To demonstrate, he produced a plastic pad, took the impression of an official's finger, and transferred it to a mirror. The jury acquitted him.

This verdict startled police officials on both

sides of the Atlantic. It tended to shatter the whole theory of the infallibility of fingerprints. Could an innocent man be convicted by a faked print, while the real criminal went unpunished, as fiction writers have often suggested?

In his police laboratory at Pasadena, Calif., William W. Harper, consulting physicist, set out to find the answer to the problem. He deliberately forged hundreds of fingerprints. Many of them, he found, could not be detected as fakes by officers using routine tests. But when he examined them under high magnification, studying the effects of temperature, dirt, and other factors, he found tell-tale differences between forged and normal prints. New methods of examination, based on the data gained in his experiments, may lead to convictions in "perfect" crimes.

As an important by-product, his study sug-



CLEWS FROM THE FLAMES

Can an arsonist leave fingerprints in a burned building? Here W. W. Harper, police physicist, subjects latent prints on a tin can to the action of heat and water. At left, prints develop clearly

By
**ANDREW R.
BOONE**

gested another question: Could fingerprints of an arsonist be found on blackened cans or among soot-darkened timbers, after flames have swept through a building?

To determine upon what surfaces prints might be heated without losing their identifying characteristics, he placed normal prints on glass slides, tin cans, enameled wood and porcelain, nickel plate, and both painted and unpainted wood. He passed each through the carbonizing flame of a Bunsen burner, laying a microscopic coat of soot over the surface. Metal objects were heated until they glowed red. Water damage in burning buildings was simulated by directing a fine stream over the sooted prints. He found that often, where carbon covered a print, the impression could be developed and identified after withstanding high temperatures which caused permanent blistering.

Enlarged photographs, made as seen in upper picture, reveal forged fingerprints. At right, Harper points to a forgery



Pup Hair Makes Puppet Wigs

PUTTING ON THE DOG

In puppetry, this may mean first "taking it off the dog." In oval, dog hair is being combed before being glued on a puppet's head

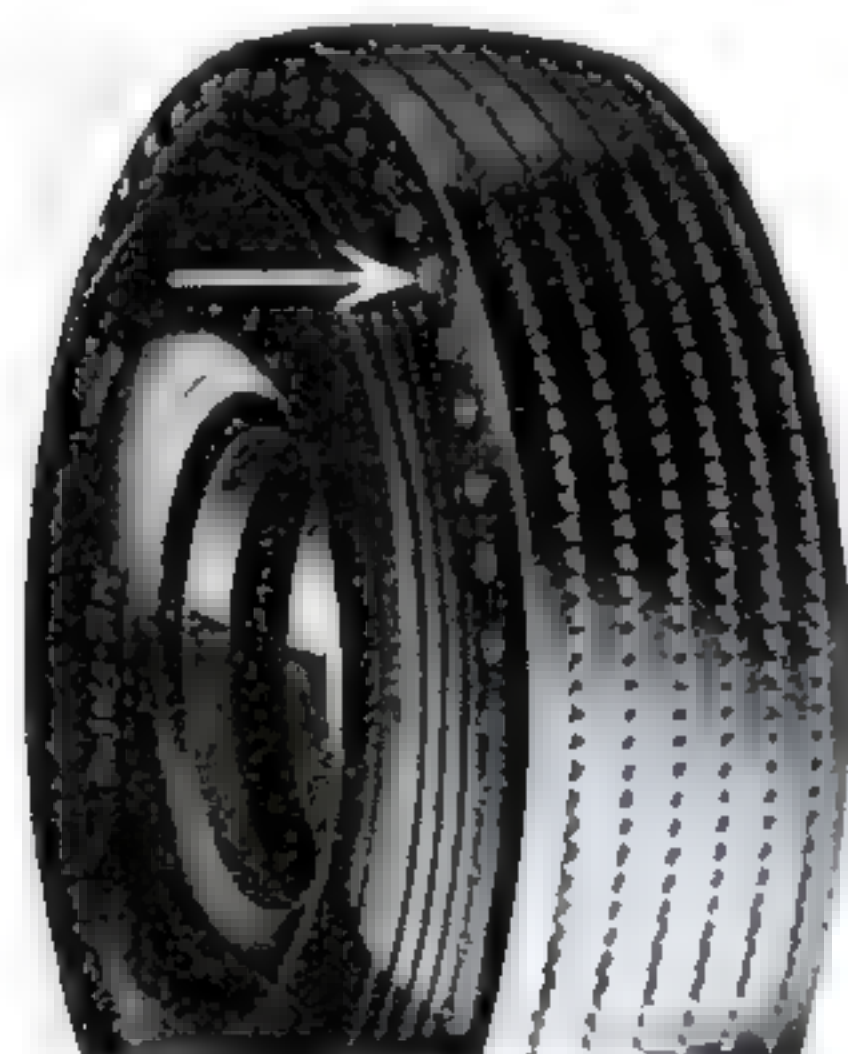


New York University puppetry-shop pupil trims the dog-hair beard of a marionette she created

ALL kinds of odds and ends furnish the costumes and features used in making marionettes and puppets. Recently, students in the puppetry workshop of the English department of New York University were seeking a realistic-looking makeshift for hair for a group of marionettes, when their instructress, Miss Catherine Reighard, hit on the idea of using dog hair. The idea took, and students added a new "property" to their already lengthy list of materials at hand for outfitting their miniature actors and actress-

es. Because dog hair is easily combed and "set," like human hair, and because it is available in a wide variety of hues, the pupils have demonstrated their resourcefulness in matching dog hair to the caricatured human types that their manikins portray. In the accompanying pictures, one of the puppetry students is shown preparing and applying a dog-hair beard, cut from a Welsh terrier, to a marionette figure designed as a caricature of George Bernard Shaw, famous British dramatist and critic.

Air Vents Keep Tires Cool



As tire turns, vents close and open to force out the heat and take in cool air

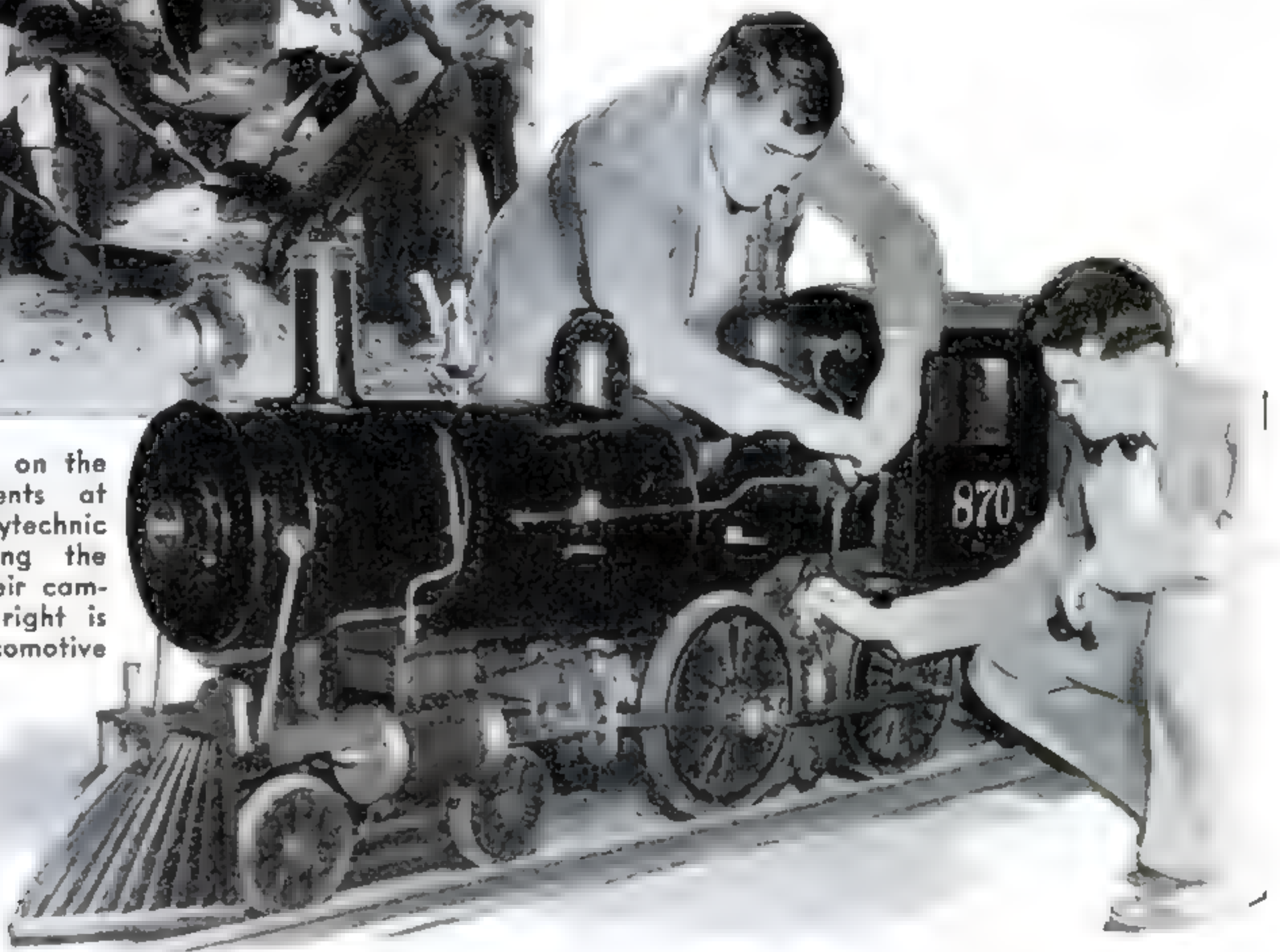


BULLET-SHAPED vents that penetrate into the thickest part of a tire casing, where blow-outs frequently are caused by overheating, are a feature in a new automobile tire. As the tire rolls on the road, the weight of the vehicle automatically closes and opens the vents, producing a circulation of air to keep the surrounding rubber cool.

Miniature Railroad Run by Students



They're working on the railroad: Students at Rensselaer Polytechnic Institute building the roadbed for their campus line. At right is their midget locomotive



A REAL live-steam railroad is now a landmark on the campus of the Rensselaer Polytechnic Institute at Troy, N. Y. Financed by students and the local chapter of the American Society of Engineers, the "Rensselaer Central" boasts over 1,000 feet of narrow-gauge track and a locomotive, built to one

sixth the normal size of the old 1890 high-wheeler after which it was patterned. Operations of the model road are controlled by student stockholders who are required to sell their holdings, upon their graduation, to new students. Track-laying and roundhouse scenes on the collegiate railroad are pictured above.

Gives Road Hogs the Bird



HORN TOOTERS, road hogs, and other highway pests are effectively put in their places by a new auto accessory invented by David E. Wilson, of Santa Monica, Calif. Operated by a dashboard control, a clown face mounted on the rear of a car sticks out its tongue and emits the sound variously known as the bird, razzberry, or Bronx cheer.



Light Socket Bends in Any Direction

ELECTRIC bulbs can be turned in any direction when they are screwed into the novel flexible light socket pictured above. Holding any position to which it is bent, the socket makes it possible to adjust a bulb for maximum illumination.

Underwater Tanks Protect War Supplies



Filled with wartime provisions, huge tanks like this could be submerged under lakes safe from enemy bombs. The odd raft at top was made by the Swiss for lowering and raising tanks.

RAW materials such as gasoline and foodstuffs that would be vital in wartime may be stored in huge tanks submerged 100 feet or more below the surface of lakes and rivers to hide them from enemy bombing planes, according to Swiss authorities who have been experimenting with the idea on Lake Thun, Switzerland. One tank having a capacity of 12,000 gallons was lowered to a depth of 100 feet, where, according to observers, it was invisible to planes flying at altitudes above 3,000 feet. Engineers are now developing plans for a rapid and easy method of raising and lowering the tanks by means of special rafts.

Rail Tester Checks Bridge Tracks

FOUR separate functions are performed by a rail gauge designed by L. V. Cantrell for use on railroad tracks across the San Francisco-Oakland Bay Bridge. It checks the distance between the running rails, the heights of the timber protecting the electrified third rail, the horizontal distance between the running rail and the protecting timber, and the height of the electrified rail above the running rails. Weighing about fifty pounds, the wooden apparatus runs along the tracks on small ball-bearing steel wheels. A visible indicator permits fast checking of measurements.



An indicator tells rail positions as the device is pushed along



Even in black and white, a shot like this would tax the skill of most amateurs

Circus Shots WITH A COLOR CAMERA

SIX nights at a circus—preceded by a year and a half of research. That is the story behind the amazing action shots in full color shown on these pages. To make them possible, Fenwick G. Small, a New York camera enthusiast, devised a whole new technique for snapping split-second pictures on Kodachrome.

Before he succeeded in catching high-speed action on color film, Small had made literally thousands of test shots. He had experimented with a host of photographic filters. And, he had developed a curious duralumin yoke, holding a miniature camera at the center and photoflash reflectors at either end, as shown in the drawing on the next page.

When he was twelve years old, Small received a cheap box camera for a birthday present. Ever since, photography has been his hobby. All told, he has owned more than twenty different cameras, eight of them thirty-five-millimeter miniature outfits. During the past two years, he has specialized in color pictures, concentrating on close-ups and speed shots.

Hardly had he begun the speed work before he ran into trouble. On his desk was a row of colored books. He photographed these over and over again, trying out exposures and testing the synchronizing mechanism which sets off the flash at the precise instant the shutter is open. When the developed films returned, every picture had a bluish cast. Small photographed the books again, sometimes using photoflash bulbs, at other times, photoflood lamps. He discovered photoflood light gave perfect results; photoflash bulbs bluish pictures.

Yet, the light given off by the flash bulbs, laboratory tests had proved, had approximately the same characteristics as the light of photoflood lamps. In the end, he found the answer to the riddle. The *sum total* of the light was the same. But, in the flash, the illumination rose to a peak and subsided again with the color characteristics varying from instant to instant. Red rays predominated at the start, blue rays at the peak of the flash, and red at the end. The synchronizer was taking a 1/125-second "bite" out of the peak at the time when the blue light was strongest. What was needed was a filter to remove the extra rays of blue.

First, Small tried a dark-yellow filter. Then he jumped to one that was nearly clear glass, with only the faintest tinge of color. From then on, he worked in from the two extremes, experimenting for weeks. When he had discovered two filters that gave fairly good results, he put a sheet of pure-white paper against his much-photographed books and snapped

more pictures. Examining these carefully, he found that those taken with one filter showed a slight reddish tinge on the white paper; those photographed with the other filter showed an equally faint bluish cast. So, Small ordered a special piece of optical glass tinted halfway between the two best filters. This "chrome-flash" filter solved the problem of getting speed pictures with the colors correct.

The next job was perfecting an apparatus which would simplify the work of arresting split-second action. Before this goal was attained, Small had designed and discarded seven different mechanisms. The eighth design makes snapping speed pictures virtually automatic.

The backbone of this device is a yoke of duralumin, two feet long and two inches wide. At the center, a compact case holds



For stopping split-second action, Small devised this yoke for camera and bulbs





Trained bear on roller skates. All these pictures were made during regular evening performances



the dry cells which set off the flash bulbs. At either end, photoflash reflectors are attached to arms that can be rotated and secured in any desired position. For close-up work, Small uses plain, silvered reflectors; for distance shots, reflectors which have the inner surface divided into a number of facets. His Contax camera is attached to the yoke in front of the battery case.

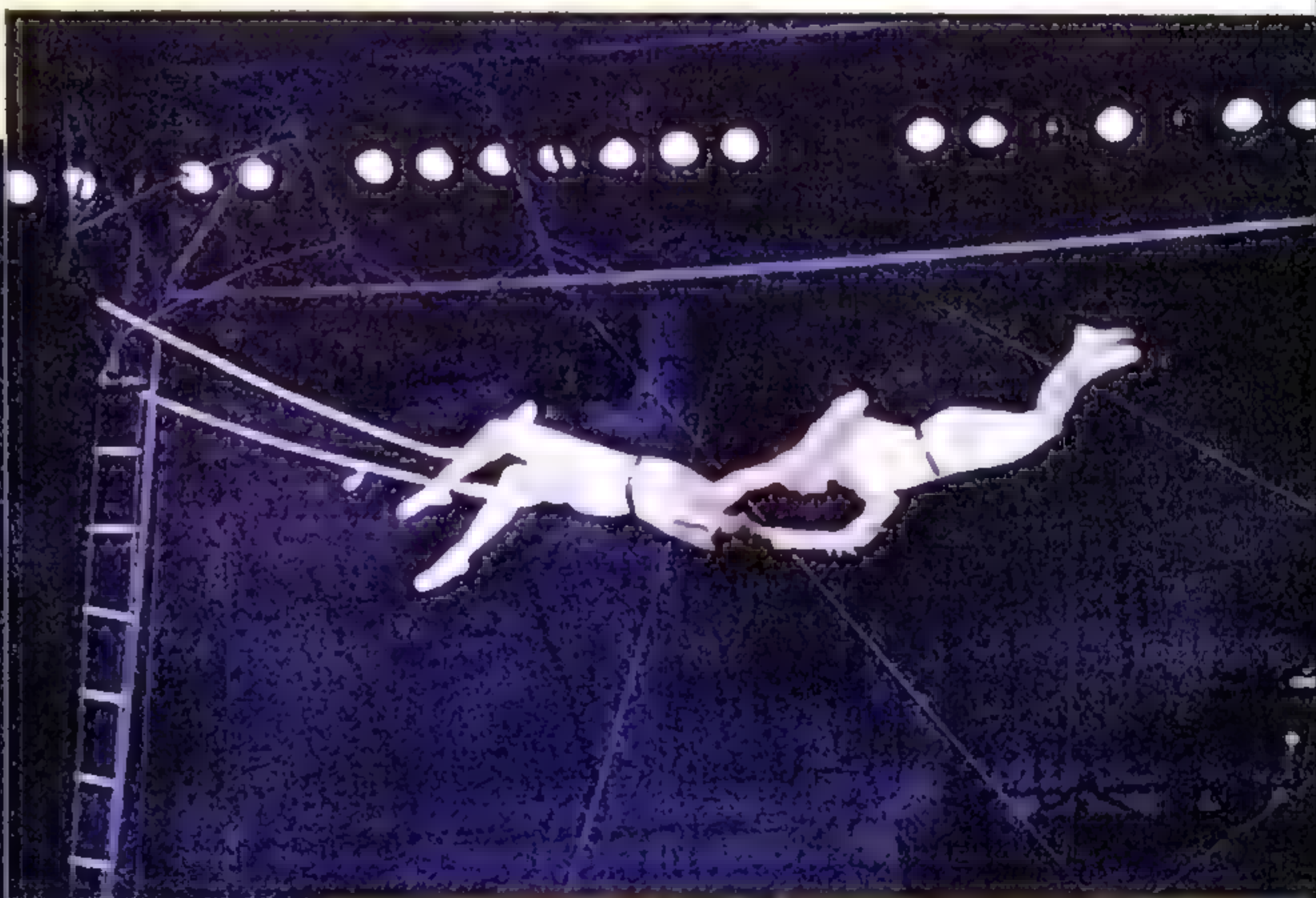
In testing out his device, Small snapped color pictures of brilliant minerals, albino frogs, and tiny lizards at the American Museum of Natural History. Then he made a series of Kodachrome shots of rare orchids, delicate flowers which could not be photographed close-up with photoflood bulbs because the heat would cause the petals to wilt. By the time the circus came to town, he had tested his outfit and was ready.

He obtained permission to roam about Madison Square Garden while the circus was there. Most of his shots were made from the





Most dramatic of this remarkable series of full-color circus photographs are those showing the aerialists in action. They were snapped at seventy-five feet, with a telephoto lens



With the lens wide open, Small's miniature camera had sufficient depth of focus to enable him to stop performers in mid-air with a 1/125-second exposure, and get every detail

Left, a performer on an elephant. Note how the camera has caught all the rich hues of circus trappings. Small uses a special filter to offset color in photoflash lighting





OOPS! OVER IT GOES!

A thrilling moment in a clown balancing act, with a stack of tables apparently on the verge of crashing to the floor

Below, an equestrian act in one of the sawdust rings. The picture not only stops the rapid movements of the performers, but also shows as a background the eager faces of spectators in remarkable detail

stairway where the performers entered and left the arena. During the first night's performance, he took no pictures. He spent his time planning out the best action to shoot and the best angle from which to shoot it.

When action takes place, as it did with most of the shots at the circus, at the same distance from the camera, Small can shoot picture after picture with no other change than replacing the flash bulbs. As photoflash light is constant, the lens opening and shutter speed will be the same for every shot.

His most dramatic pictures, those of the aerialists in action, were made at a distance of seventy-five feet. Two twenty-five-cent-size wire-filled photoflash bulbs provided the illumination. With the F/2, eighty-five-millimeter Sonnar lens used wide open, a 1/125-second exposure proved ample. When the Contax camera was focused at seventy-five feet and the lens was left wide open, the depth of focus, that is, the distance from the nearest to the farthest object in the picture in perfect focus, was approximately forty-five feet. This enabled Small to stop the catapulting trapeze performers in mid-air in his pictures and still be sure he had every detail sharp and clear.

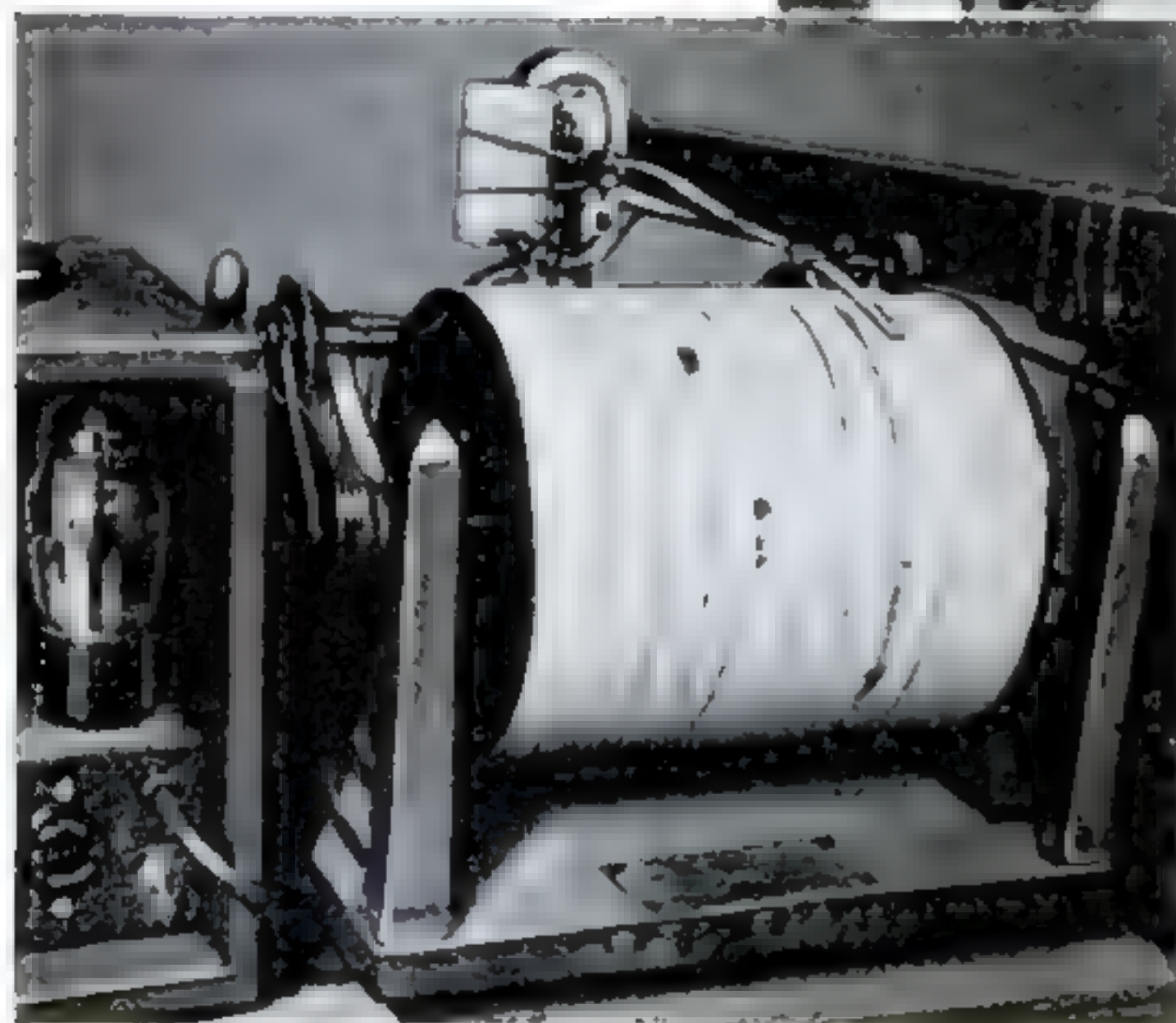
During his six nights at the circus, Small used up between 200 and 300 flash bulbs. But, he made photographic history. His pictures recorded, for the first time in color, breath-taking night thrills of the big top.



Earthquake Listening Posts



Microphones like this are hung in abandoned wells to catch earthquake rumblings



Scientists checking up on one of the listening posts. Subterranean sounds are recorded on drums like the one seen at the left. Drawing at right illustrates the typical installation

inch moving drum the wave patterns of the underground vibrations. To make sure that the sounds picked up come from the depths of the earth and not from the surface, one microphone was raised from the bottom half way to the top

of a 360-foot well. At this point, recorded sounds were perceptibly fainter, and grew louder once more when the microphone was returned to the bottom, thereby proving that the vibrations were of subterranean and not of surface origin.

Previous experiments have shown that microphones on the bottoms of lakes are of little or no value, since they pick up the sounds of distant pumps, of waves lapping the shore, or even of falling grains of sand. That deep underground noises rarely reach the earth's surface was demonstrated by the fact that underground vibrations recorded on the Government charts made no impression whatsoever on seismographs in the vicinity, which register slight surface tremors even at points thousands of miles away.

DOES the earth broadcast warnings of impending earthquakes? Deep down in abandoned wells along a geological fault in California, magnet-type microphones have been suspended by scientists of the U.S. Coast and Geodetic Survey to pick up deep-throated rumblings caused by the shifting movement of huge rock masses far below the surface of the earth. By studying the strength and frequency of this subterranean thunder, it is hoped, it may be possible to work out a formula for predicting the time and place of future earthquakes.

Wires leading from microphones suspended in wells along the northern and eastern shores of San Francisco Bay are connected through amplifying units to automatic, motor-operated stenographers which trace on a six-

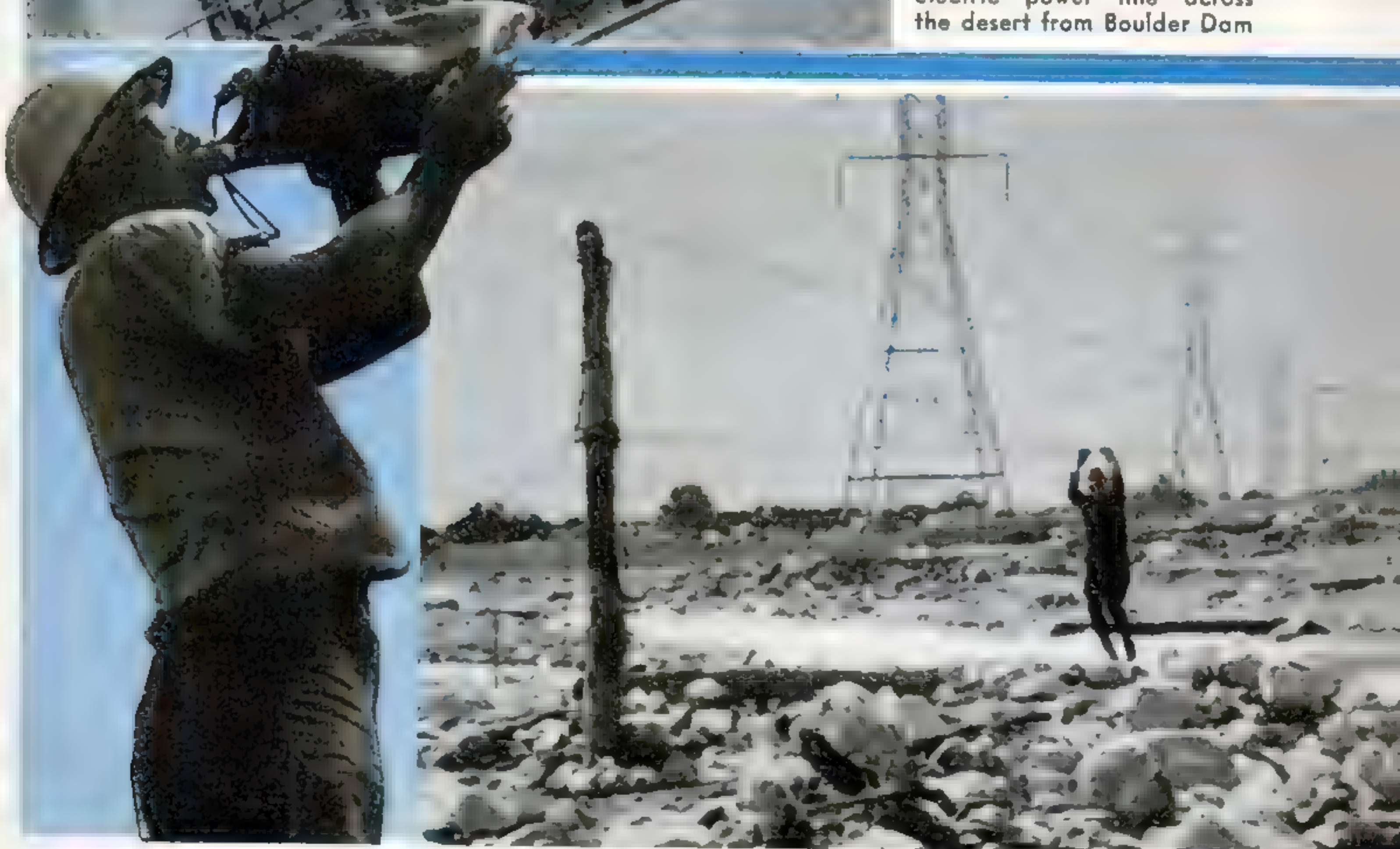


HERDING

IMAGINE "shooting trouble" on a power line strung from towers so high that eagles use them for nesting places; where you remove stray kite strings with a bow and arrow, clean dirty insulators with a 1,100-pound jet of water, and splice severed wires with a hack saw and a wrench!

If you had my job herding kilowatts over the world's "hottest" power circuit—two parallel strings of steel towers forming a double-track 266-mile electric highway from Boulder Dam to Los Angeles—you'd do most of your patrolling from the comfortable seat of a coupe,

Massive insulators and lightning arresters at the Los Angeles terminal of the giant electric power line across the desert from Boulder Dam



KILOWATTS on the world's 'hottest' power line

and look for flaws in conductors and insulators with field glasses. But when you climbed one of the steel towers, tall as a fifteen-story building, a quarter of a million volts would crackle about your ears. Even a dead wire disconnected for repairs would be as dangerous as a rattlesnake until carefully grounded—and, should lightning strike your tower, you would be burned to a crisp.

I have patrolled the giant "high line" through a mile-high pass when sudden cloudbursts brought torrents down the slopes and sent huge boulders hammering at tower foundations. I have seen sleet storms load the heavy conductors with an inch and a half of glittering ice, adding tons to the weight carried by the insulators. I've climbed 144-foot towers when the great conductors stood out almost horizontal from the towers, driven by a howling gale—and have made my patrol in a rowboat when a cloudburst turned a dry desert mirage into a real lake eight feet deep.

As told to
**STERLING
GLEASON**

But thrills like that are rare, and most of our patrols are just hot, dusty drives across the desert, with sidewinders and scorpions providing most of the excitement. Lizards of various sizes and hues scurry across the sand, and, in one valley, giant desert turtles are so numerous that often they block the road.

Early each morning, as the sun slants long shadows across the desert, my partner and I draw a car from the "pool" of twenty-odd light coupes kept always in readiness for the patrolmen; check the pressure in the huge air wheels, built to walk over loose sand like a water strider; then swing into the seat



Patrolman shooting a kite off the line with a bow and arrow. At the left, linemen are crossing a swollen stream on a tight-wire bridge

Below, a worker is climbing a tower on which insulators are being installed. Right, attaching a cable to one of the long insulator strings. The job of the power-line patrolman is to keep these towers and cables in order



bottom to top. Eagles have tried to build nests in the lofty lattices, bringing sticks and bits of rubbish that must be removed. Bolts sometimes loosen and cause intermittent sparking in the terrific field near the cables. With powerful binoculars my partner scans every foot of the tower and studies the ribbed skirts of the insulators for signs of damage. I walk around to inspect the spark gap on the lightning arrester—keeping a cautious eye

and head out along the narrow road cleared out through the sage, parallel to the high line. In the remote desert sections, far from the main road, we always work in pairs, for a lone man who met with an accident, or was overcome by heat, would probably perish before help reached him.

On the dash, a special radio receiver is tuned to the "carrier-current" transmitter of the chief dispatcher's office in Los Angeles. These "wired wireless" broadcasts never go on the air, but ride the high line itself. They may be picked up only along the line by cars equipped with special receivers.

As we roll along, we carefully scan the three cables, foot by foot, watching for frazzled sections indicating lightning scars. We look critically at the vibration dampers—small weights clamped to the cables at chosen points to prevent wind swinging the cables rhythmically like a child's skipping rope, and wearing them out.

At each tower we stop to look it over,

out, meanwhile, for rattlesnakes and black-widow spiders, which like to rest here in the shade. Often a hairy tarantula scuttles off at my approach.

Far overhead, at the very top of the towers, stretch the continuous wires forming the world's longest lightning rod—a 266-mile "overhead ground" which cages the cables against electrical storms. By making it easier for the lightning to drain off to ground than to flash across the insulators, engineers figured on making the line positively immune to all shocks below 16,000,000 volts. Since most flashes are of less intensity than that, they expect, on the basis of lightning statistics, not more than two actual "flash-overs" in a year for each hundred miles of line.

Now and then, however, a bolt of lightning strikes a tower and flows down the steel framework, jumps across a tiny air gap, and into a buried "counterpoise" or network of underground wires fanning out from the towers. A sheet of flame plays over the

plastic shell of the spark gap, suddenly heating it so intensely that it literally explodes, completely shattered as if by a rifle bullet. Engineers tell me that some burns on these gaps indicate currents of 100,000 amperes.

If the spark gap is damaged, I replace it; then, holding in my hand an ordinary magnetic compass, I walk out along each buried wire to see if any are broken. Sometimes I am saved this trouble, for occasionally a cloudburst races down a dry wash and neatly excavates the surface dirt, exposing the fan-shaped network of wires to full view.

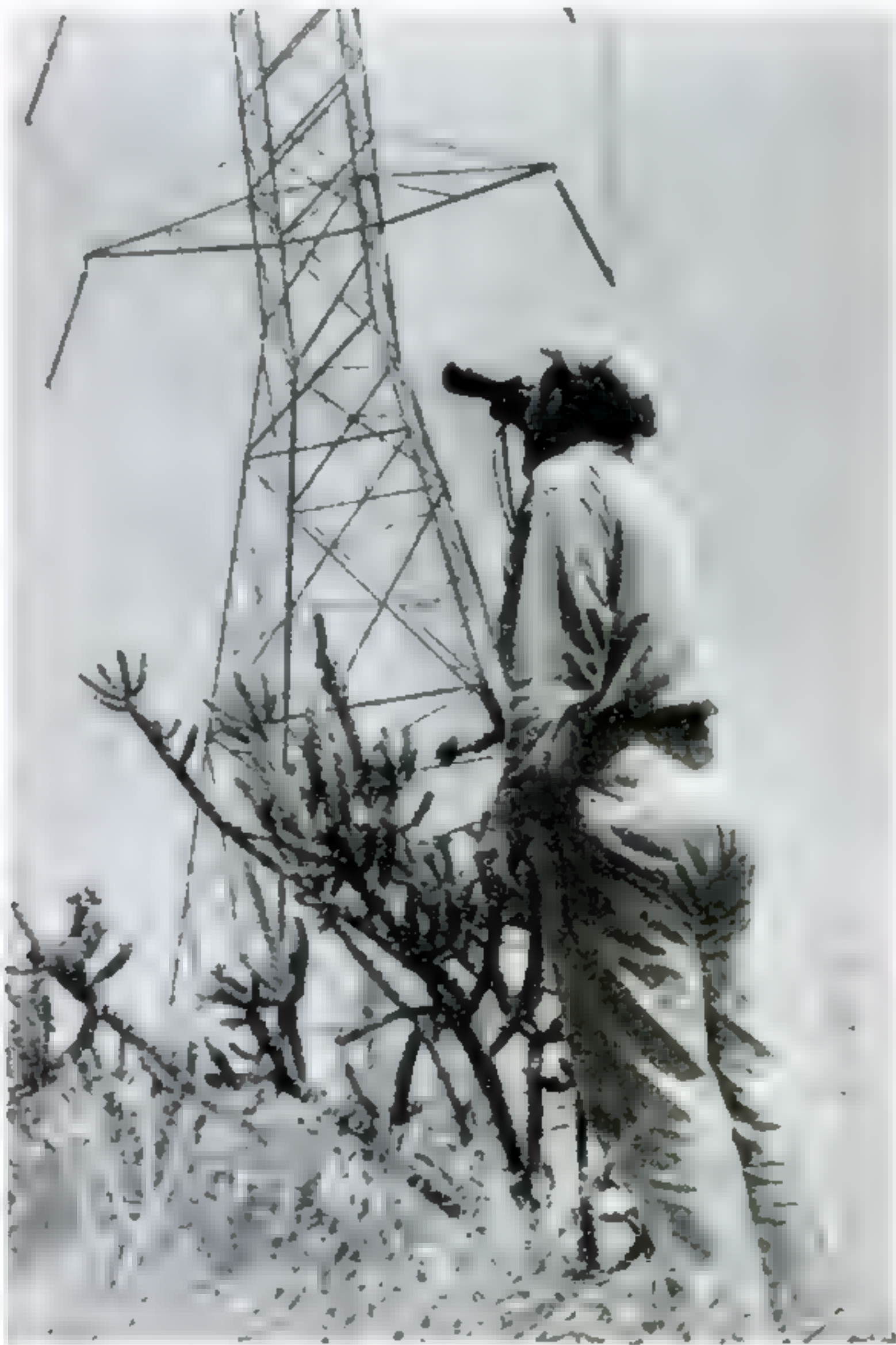
As the day advances, the heat is intensified. The thermometer passes the 110-degree mark and stays there. The jack rabbits and the snakes seek shelter, and only our car moves through the desert. We creep slowly along, keeping an eye on the right of way as well as the high line. Now and then a prospector or homesteader decides to build a shanty on this apparently waste land and has to be warned away. Before noon we have reached the end of our thirty-mile patrol and turn back in time to have our lunch at home.

Working in the desert isn't so bad if you know how—and every patrolman has been well schooled in guarding against the various hazards of high-line work. He has had actual practice in using the first-aid kit we carry—treating for electric shock, administering serum for snake bite, and treating hemorrhages. He knows the difference between sunstroke, where the victim gets too hot and must be cooled off, and heat prostration, where he goes cold from an overtaxed heart and needs blankets and warm stimulants. In the summer, when the thermometer daily may reach 120 degrees, patrolmen get individual advice on hot-weather diets and clothing. We are cautioned never to remove our shirts in the blistering sun, but to wear flannel shirts and warm hats—not Panamas—to afford some insulation against the superheated air.

"Keep the kilowatts moving!" is the motto of the patrol. When trouble strikes, our first duty is to restore service as quickly as possible, so we seldom make more than temporary repairs at the time. Later, at a week-end when industrial plant loads on the line are lightest and a section of line can be taken out of operation without affecting electric service to consumers, permanent repairs are made.

At midnight Saturday, at the switching stations placed every ninety miles along the high line, operators open the giant remote-control switches and "kill" the portion of the line to be repaired. Over the control knobs they place red fiber caps plainly marked "Men at Work" so that the power cannot be accidentally connected. Not until every man has reported in and a final O.K. comes over the wire from the dispatcher's office, is the line put back into service.

Thanks to long training, most line crews work with the smooth precision of a well-drilled football team and a repair job goes swiftly forward. Every man is an experienced



Field glasses help find flaws in insulators and conductors. Left, fiber caps cover switchboard controls to show sections of line on which men are at work

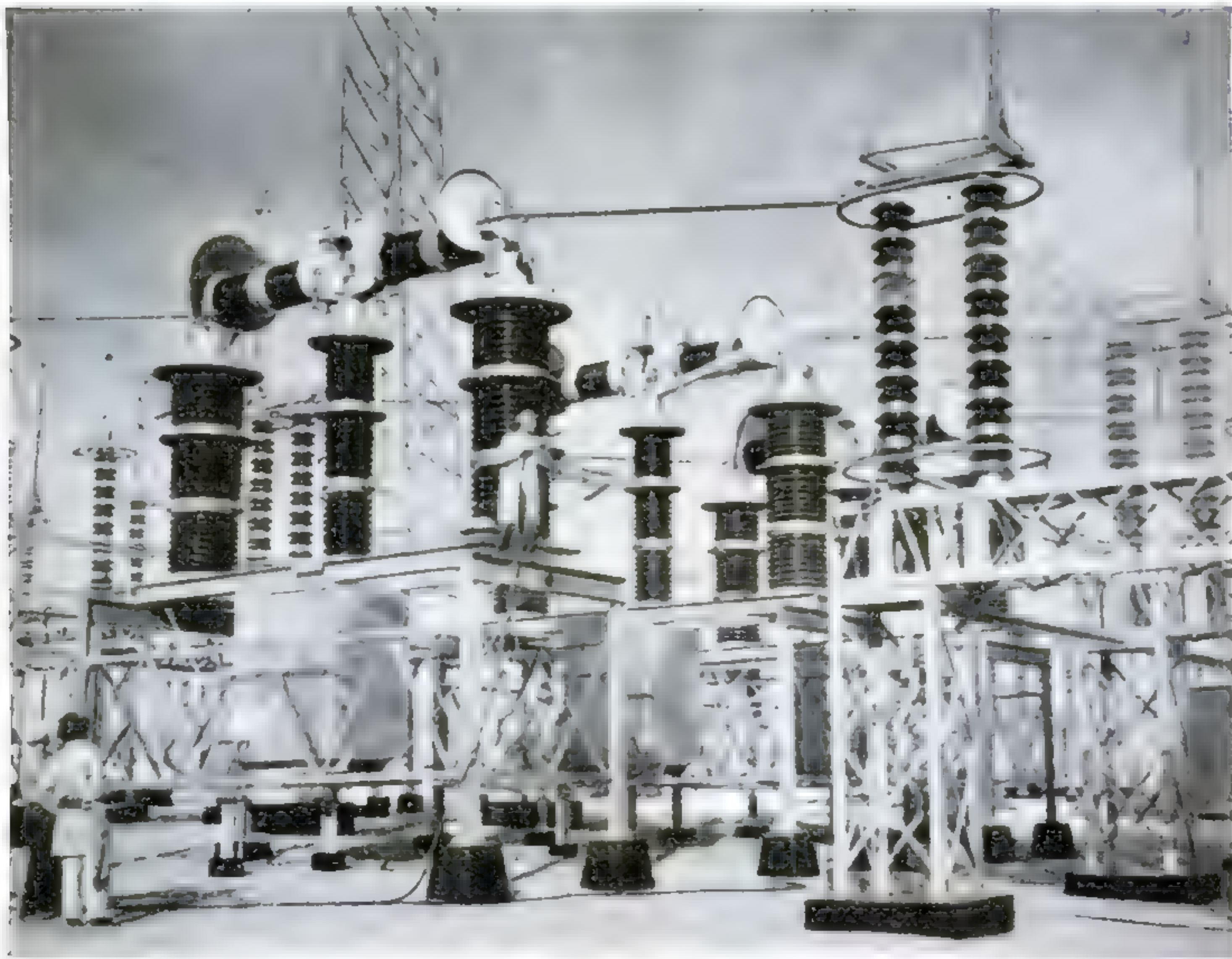
journeyman lineman who has undergone a special high-line training course lasting from two to five years. Splicing the heavy cable, half as thick as a man's wrist, with ten interlocking strands of tongue-and-groove copper strips wound into a hollow tube, is a job requiring a special technique practiced only by high-line patrolmen. No one else is allowed to touch these circuits.

On this giant of high lines, even a disconnected wire may pack a powerful wallop. The mighty surge of current along the other and parallel line of towers, builds up induced currents in the "dead" line that may reach 30,000 volts! Hence an experienced patrolman goes about his repairs with the methodical caution of a man handling nitroglycerin. Before he even approaches the tower, the section to be worked on must be "chained" or grounded on both sides of the splicers, to short-circuit stray currents. Last year a lineman who forgot this initial step was instantly killed when he contacted a bare cable heavily charged with induced current.

One patrolman enjoys the distinction of being the champion pitcher of the high-line patrol. He can throw a light hand line of

paraffined cord to the top of an eighty-six-foot tower, putting it over one, two, or three conductors at will. For the higher towers, he used a regulation archery bow and arrow to shoot the line over the cables, then pulls up a quarter-inch plow-steel cable which is firmly grounded to a tower leg. Next a five-eighth-inch steel messenger cable is stretched from tower to tower. This supports the big boatswain's chair weighing about 160 pounds and capable of carrying four men. Riding out aboard this chair, we saw out the damaged section of the cable. Into the breach goes an ingenious nine-piece, prefabricated splice—a section of cable ending in wedge-shaped tips which are inserted into the hollow conductor. An encircling ring keeps the strands from spreading while the wedge is tightened by screwing it together with a wrench until the copper is firmly clamped together in a secure, solderless joint. On more than one occasion we have made a complete splice in half an hour, counting from the time we left the ground to the time we were back down again.

Keeping the giant insulators clean is one of the routine jobs (*Continued on page 244*)



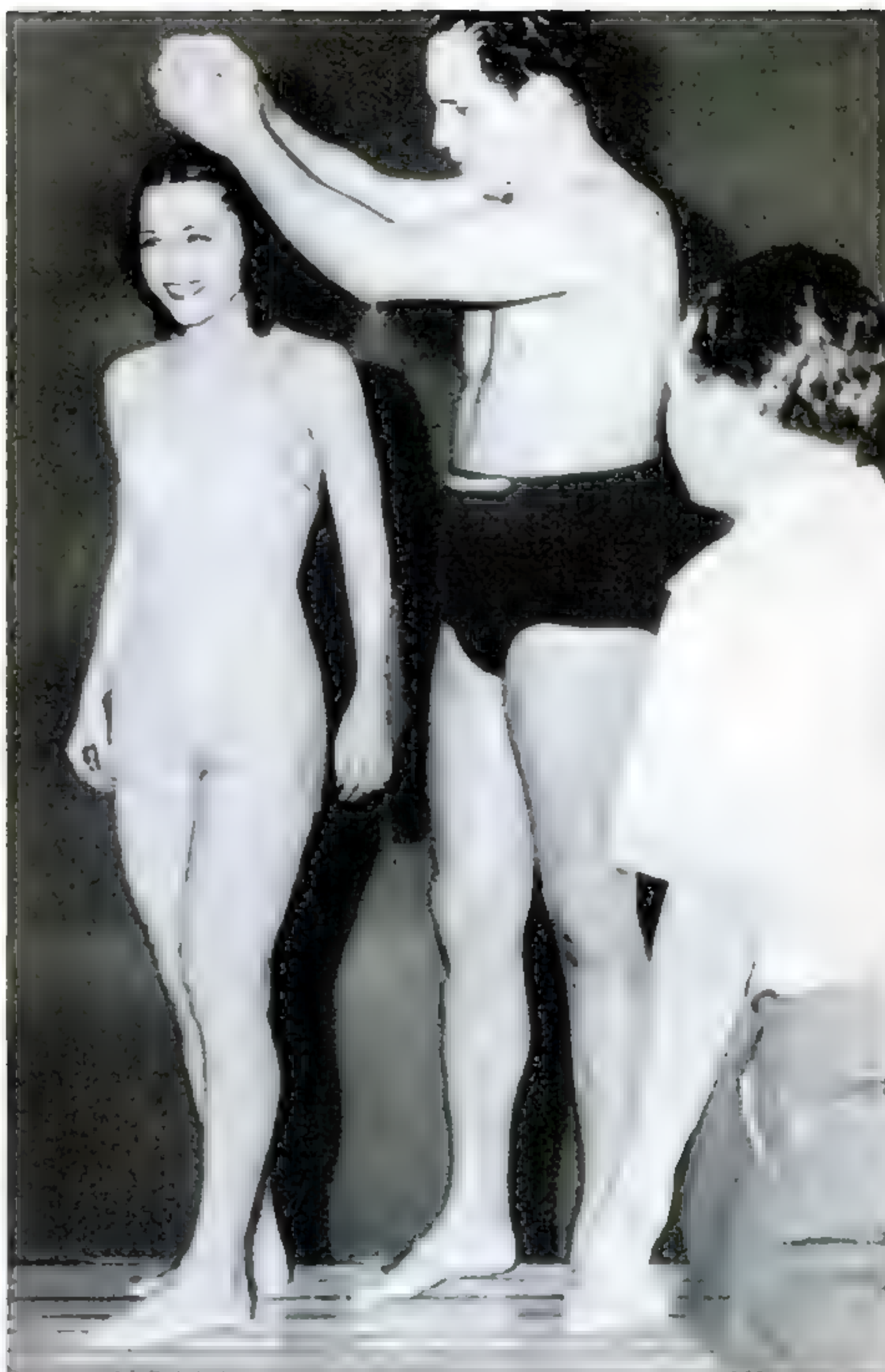
Washing insulators and lightning arresters at a switching station. At regular intervals, every insulator on the line, from Boulder Dam to Los Angeles, gets a bath to remove the dust and grime it has accumulated

Compact Tester Tells Condition of Oil in Motor

MOTORISTS can quickly check the condition of automobile crankcase oil with a new vest-pocket tester. The device has two synthetic-rubber frames hinged together, one having a lens and the other a test glass. When a few drops of oil are placed in a groove in the latter, and the lens cover closed, the user looks through the lens at the thin film of oil underneath. By comparing its color with standard shades appearing on the test glass, the amount of contamination in the oil can be judged. Abrasives in the oil can also be detected.



In a series of simple operations, the unit tests motor oil for its dirt, viscosity, and slipperiness



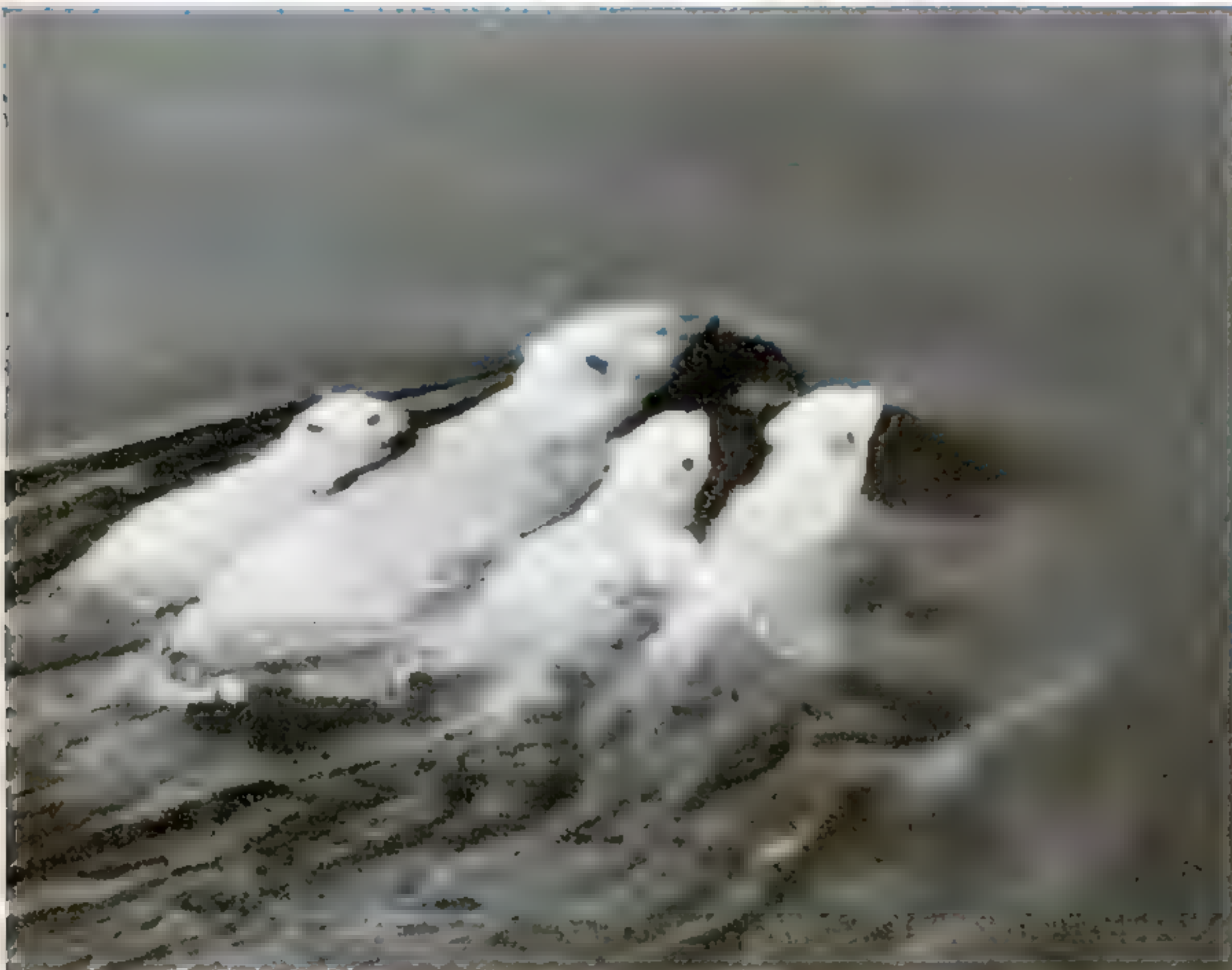
Oil Doubles for Water in Movies

BECAUSE water would not photograph so that it looked "wet" enough, movie technicians working on a new film poured mineral oil on the actors to make them look wet in a bathing-suit scene. The photograph above shows Frederic March, film star, helping out by giving an actress a mineral-oil bath. The oil creates skin high lights that produce a realistic wet appearance on film.

Heat Rays Attract "Flying Torpedo"

A NEW-TYPE "flying torpedo" credited to German inventors has a photo-electric cell in its nose that guides it directly toward a blast furnace, power house, battleship, or any other source of heat. The visible light rays do not affect the light cell, but the infra-red heat rays enter the cell to actuate controls that make the torpedo turn toward their source with its deadly burden of high explosives.

HUNTING POLAR BEARS



A camera hunter got this remarkable shot of a mother polar bear swimming with her cubs



A seal, shot from the deck of the ship, is gently hoisted aboard

WITH GUN AND CAMERA

SPORTSMEN FIND NEW THRILLS
IN BAGGING RARE ARCTIC GAME
FROM DECKS OF CRUISE SHIPS

SHOOTING big game from the deck of a cruise ship seems like a topsy-turvy idea. But that is just what sportsmen are doing, during the short arctic summer, off the northeastern coast of Greenland.

All-wooden ships take them on "hunting cruises," offered by most Norwegian steamship companies, over the viking sea route to North America. Some of the passengers are professional hunters in quest of polar bears and other fur-bearing animals, such as seals and arctic hares. The rest are amateurs, lured by the novel sport of hunting afloat with their guns and cameras.

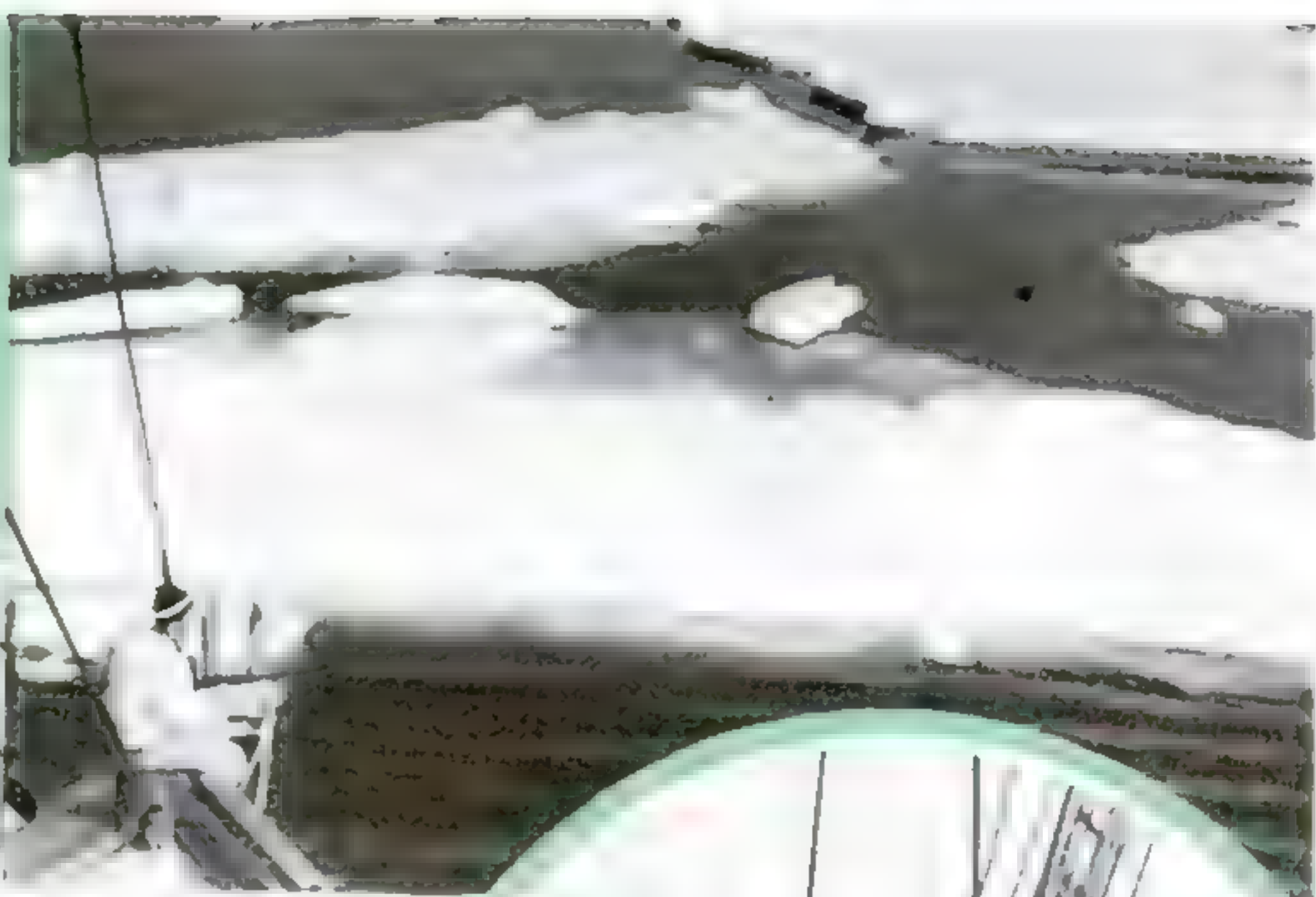
Not the least of their thrills comes from navigating the tortuous channels that the captain manages to find through menacing ice jams. As the vessel makes its leisurely progress, any place at bow or rail offers a point of vantage for the marksman. "Bears afloat!"

From the crow's nest, the lookout scans the ice floes for game. Below, a hunting party brings in a bear killed far out on the frozen waste





The skipper, a modern viking, pilots his frail wooden ship through the tortuous channels in the floating ice, while . .



. . on the bow, a hunter holds his rifle ready



Talk about big-game hunting! A kill like this is a good load for the ship's derrick. At the left, a seal has been shot on the ice. If not killed instantly, the seal dives into the water and is lost



Musk oxen at bay. They face out in a circle, with the calves in the middle

sings out the lookout. A rifle cracks. If the aim has been true, a wooden ladder goes over the side, and a rope is made fast to hoist aboard the makings of a fine white pelt. A seal basking at the edge of an ice floe tests a hunter's skill, for it will dive into the water and be lost unless it is killed instantly.

Small islands, bare of snow in the summer season, invite side trips ashore to restock the ship's larder with fresh food—wild ducks and geese, hares, and the ponderous musk oxen of polar regions, whose meat is compared to the finest domestic beef. Instinctively grouping themselves for defense in a circle, with the calves at the center, a herd of musk oxen offers a tempting shot to camera hunters.

Laying aside his camera, the photographer bagged these fluffy, white arctic hares on one of the barren islands





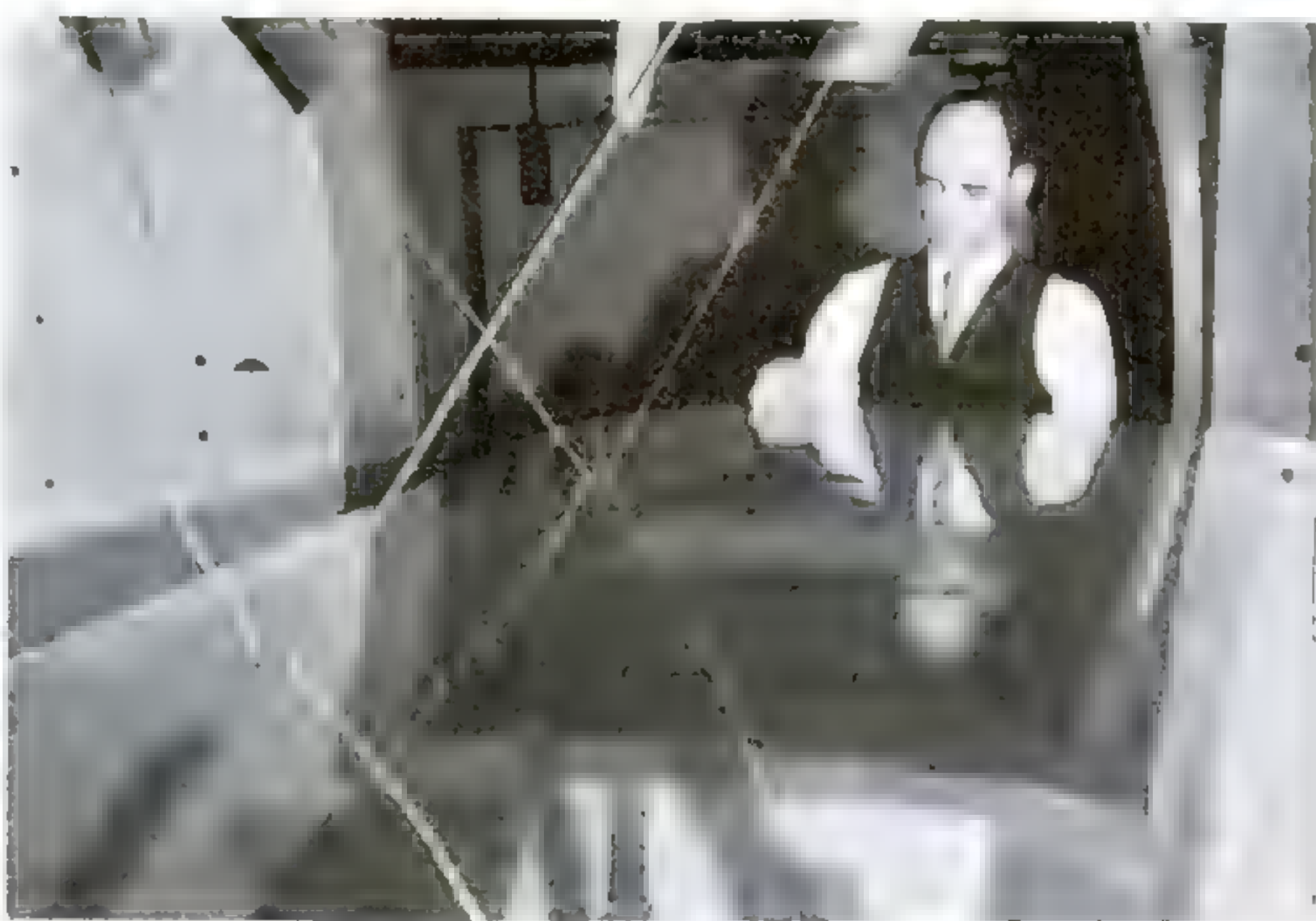
Both the seats and backs of these chairs are adjusted to a child's size

Nursery Chair Can Be Adjusted As Child Grows

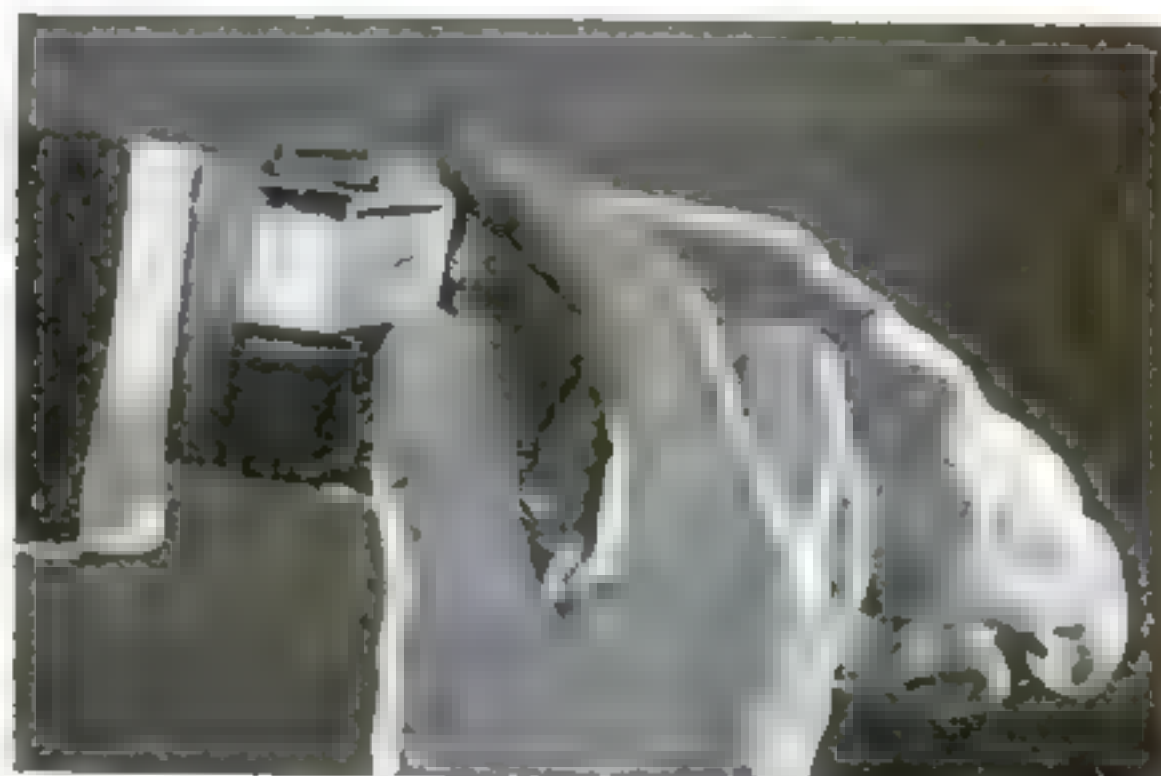
BUILT to grow with its owner, a nursery chair just introduced on the furniture market can be used from the time the child first begins to walk until he is about six years old. Simple in design, the chair has adjustments by which it can be made to give the correct support for the most healthful posture. As indicated in the photograph at the left, the seat and the back rest of the chair are held in place by pegs and can be raised or lowered to fit the size of the child for whose use it is intended.

Polished Wings Speed Planes

THE relation between airplane speed and smoothness of wing surfaces is being checked in a series of tests in the wind tunnel of the California Institute of Technology. Preliminary results indicate that top speeds of airplanes may be increased as much as forty miles an hour by wing surfaces that are smoothed and polished to mirrorlike brilliance, such as the one being subjected to tests in the photograph at the right.



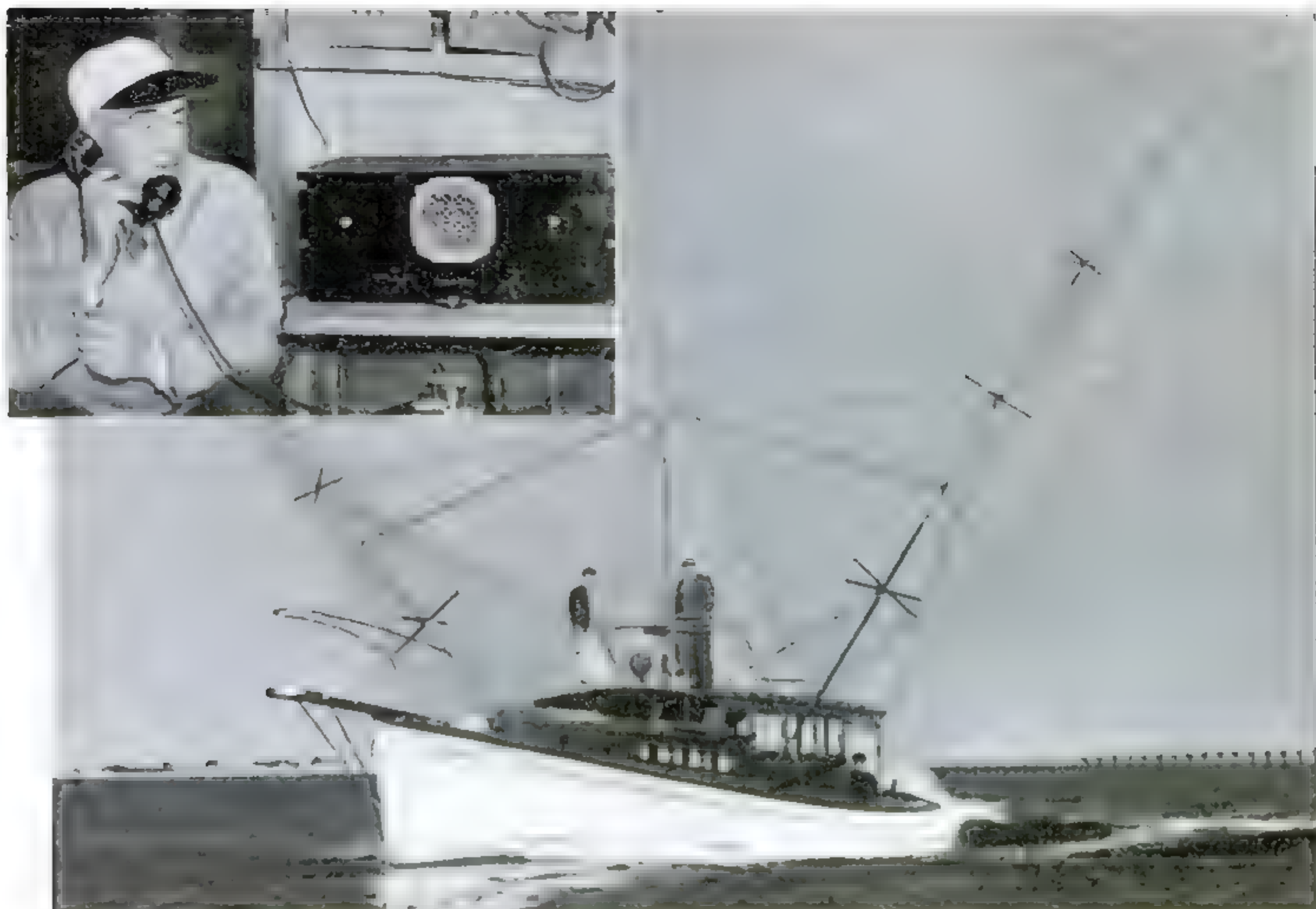
Wind-tunnel tests being made on a highly polished wing to show its efficiency



How the wrist watch is turned over to bring the dial into view

New Wrist Watch Is Reversible

REVERSIBLE in its metal case, a novel wrist watch now on the market can be worn face down to provide protection for the dial. The change is made by slipping the watch sideways in the case and flipping it over. A catch holds the watch firmly in either position.



Boat's Outriggers Serve As Radio Antenna

MEL ELDERS, captain of a fishing cruiser plying waters near New York City, extends the range of his two-way radiophone by making the craft's outriggers, normally used to

hold big-game-fishing lines, double as masts for antenna wires. When the outriggers are lowered to a horizontal position, the radio has a range of more than 150 miles, Elders says.



Three machine guns and an antiaircraft cannon form the tank's armament

Speedy Tank Designed for Air Defense

RACING along a highway at 114 miles an hour, a 10,000-pound camouflaged tank was recently demonstrated before Army officers at Rahway, N.J., by its inventor, Preston Tucker, Jr., of Indianapolis, Ind. Tank, antiaircraft weapon, and armored car in one, the war machine has three machine guns and a turret-mounted antiaircraft cannon that will fire 120 shells a minute.

Blacksmith Forges Tom-Thumb Tools

Hand forging is not a lost art to this Ohio blacksmith, who makes tiny tools as a hobby

Adz, drawknife, chisel, hatchet, and saw make just a good handful



WITH skill and attention to detail that a fine jeweler might envy, Harry Shreffler, Wadsworth, Ohio, blacksmith, forges miniature steel copies of common tools used by machinists, carpenters, blacksmiths, and other craftsmen. Turning out Lilliputian tools has been Shreffler's hobby for over

thirty years, and today he has a unique collection of more than fifty items, including midget hammers, chisels, saws, anvils, tongs, and even tiny horseshoes that illustrate the various types made by blacksmiths. Tiny hammers and other tools that would be lost inside of a wrist-watch case, are forged by hand from ordinary tool steel. His diminutive pincers and other jointed tools actually work, and the microscopic saw will cut wood. Chisels and other edged tools, however, are purposely dulled to prevent injury to visitors who handle them. Apart from their diminutive size, Shreffler's midget tools are of interest because they are fine examples of the ancient craft of hand forging, which is now disappearing before the onslaught of modern automatic machines and steam hammers.

More than fifty tools are included in the collection. The pincers and other jointed tools all work, and the tiny saw actually cuts wood

Voice Analyzer Is Aid to Deaf

DEAF children are taught to control the pitch of their voices by a novel electrical device invented by A. H. Coyne, of Capetown, South Africa. Diagrams written on a blackboard show a child how he should pitch his voice when speaking a sentence, while flashing lights on the right-hand edge of the board indicate as he is speaking whether his voice is too high or low. A microphone picks up the pupil's voice to actuate the signal lights.



As the lighted disk moves, a deaf child "sees" his voice pitch changing



Wax Filler Protects Trees

RUBBER and wax combine to fill and protect tree cavities under a system now being employed by tree surgeons. The cavity is first given an outer filling of flexible, interlocking rubber blocks. A portable machine then generates steam pressure to force sterilized wax behind the rubber patch, as shown above. The wound is thus sealed against water and decay, although the filling remains pliable.

Painted Cup Tells Tea-Leaf Fortune

ANYONE can tell fortunes to amuse friends by reading tea leaves in a novel teacup now on the market. Tiny playing cards and numerals are painted on the inside of the novelty. As tea is drained, some of the tea leaves adhere to the sides of the cup. The particular cards or numerals that are covered by leaves are used to indicate a person's tea-leaf fortune according to instructions contained in a booklet.



Tiny cards and numbers printed in the cup tell the tea-leaf fortune

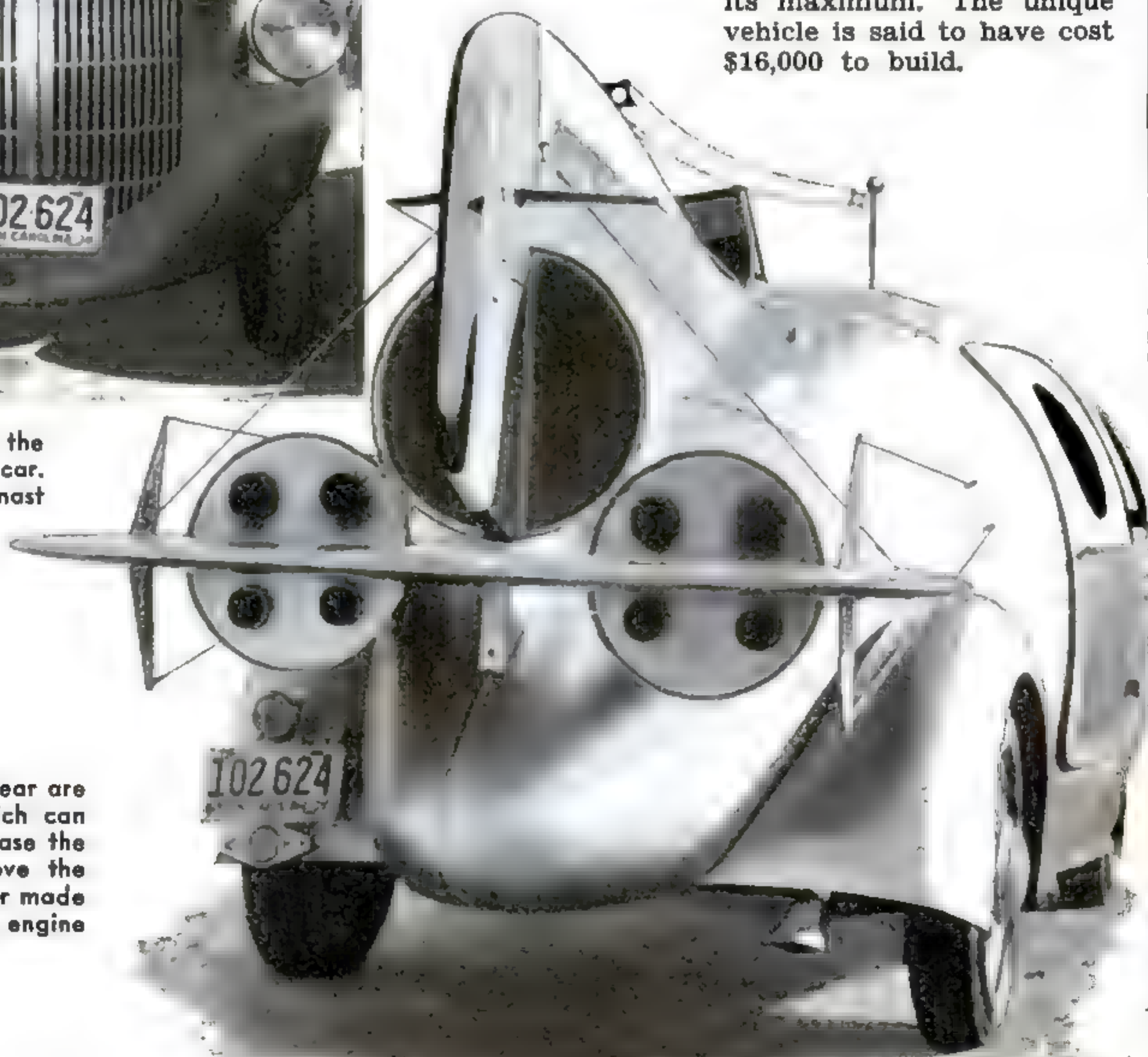


Rockets Boost Bullet Car's Speed

CLOSELY resembling the fuselage of an airplane, a curious speed car designed by Peter Vacca, of Buffalo, N. Y., is powered by both a gasoline engine and a rocket motor. Fitted with a body made of aluminum, the streamline automobile measures twenty feet from the tip of its snub nose to the ends of the airplane-type rudders and stabilizers at its rear. Propelled by its gasoline power plant, an eight-cylinder V-type engine fitted with a supercharger, the radio-equipped bullet car will attain a speed of 115 miles an hour. At this speed, it is planned to bring the rocket vents into play to boost the car's speed to its maximum. The unique vehicle is said to have cost \$16,000 to build.



Nose-on view of the superstreamline car. Note the radio mast



Mounted at the rear are rocket vents which can be used to increase the car's speed above the 115 miles an hour made possible by its engine

Marionettes Learn To Smoke

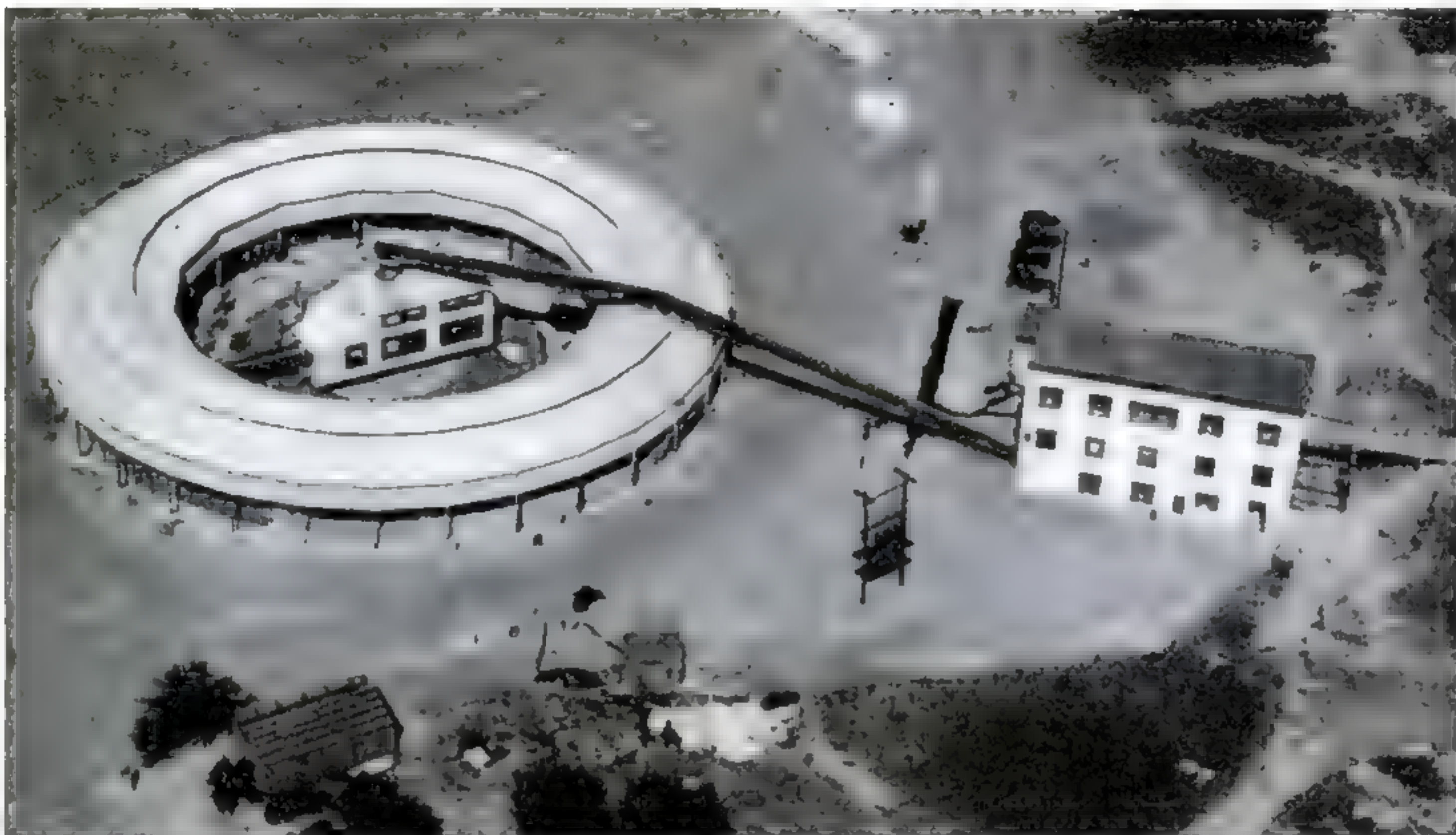
MAKING a marionette light up a cigarette, inhale the smoke, and blow it out, is the high spot in a puppet show produced by an Italian group now touring the United States. Manipulated by two operators, the marionette smoker struts onto the stage with a cigarette lighter held in one hand and a cigarette in a holder gripped in the other. Under the guidance of invisible strings operated from above, the puppet raises the cigarette to his mouth, strikes up a flame, and applies it to the cigarette end. A bellows, built into the body of the marionette and controlled by a special string, sucks in and blows out the smoke.



The marionette actor raises the cigarette to his lips and then operates the lighter

Front view, showing mouth opening into which the cigarette holder is inserted. At far right, puppet is blowing out smoke, with operators above





Circular Kiln Speeds Brick Making

SECTIONAL drying kilns constructed in a circle around a cutting and processing building are a feature of a novel brick-manufacturing plant near Baltimore, Md. Said to be the first of its kind in the world, the brick factory has an exceptionally high operating

efficiency, due in part to the fact that drying equipment is trundled around on a circular track to treat the stacked bricks, instead of the bricks being transported to stationary drying ovens. An aerial view of the circular kiln is shown above.



Insulation for Wiring Comes in Liquid Form

ELECTRIC wires can easily be sealed against current loss by means of a liquid insulating material now available. Where wires are exposed to weather, the liquid is brushed on. It is said to harden quickly into an efficient coating of waterproof insulation.

Amplifier Mounted in Mobile Pulpit

WORKING mostly with scrap materials, Lieut. James Burdett of the Troy, N.Y., Salvation Army corps constructed the ingenious mobile pulpit shown at the right. The plywood unit, which weighs about 200 pounds, is mounted on rubber-tired wheels and contains a battery-operated amplifying system and loudspeaker, a microphone, and a phonograph turntable. Space is also provided for hymn books, bible, records, and trumpet.



Suburban Cops Save Their Feet with Scooters



These patrolmen can tour their beats at a thirty-mile-an-hour clip. Scooters with side cars also are used

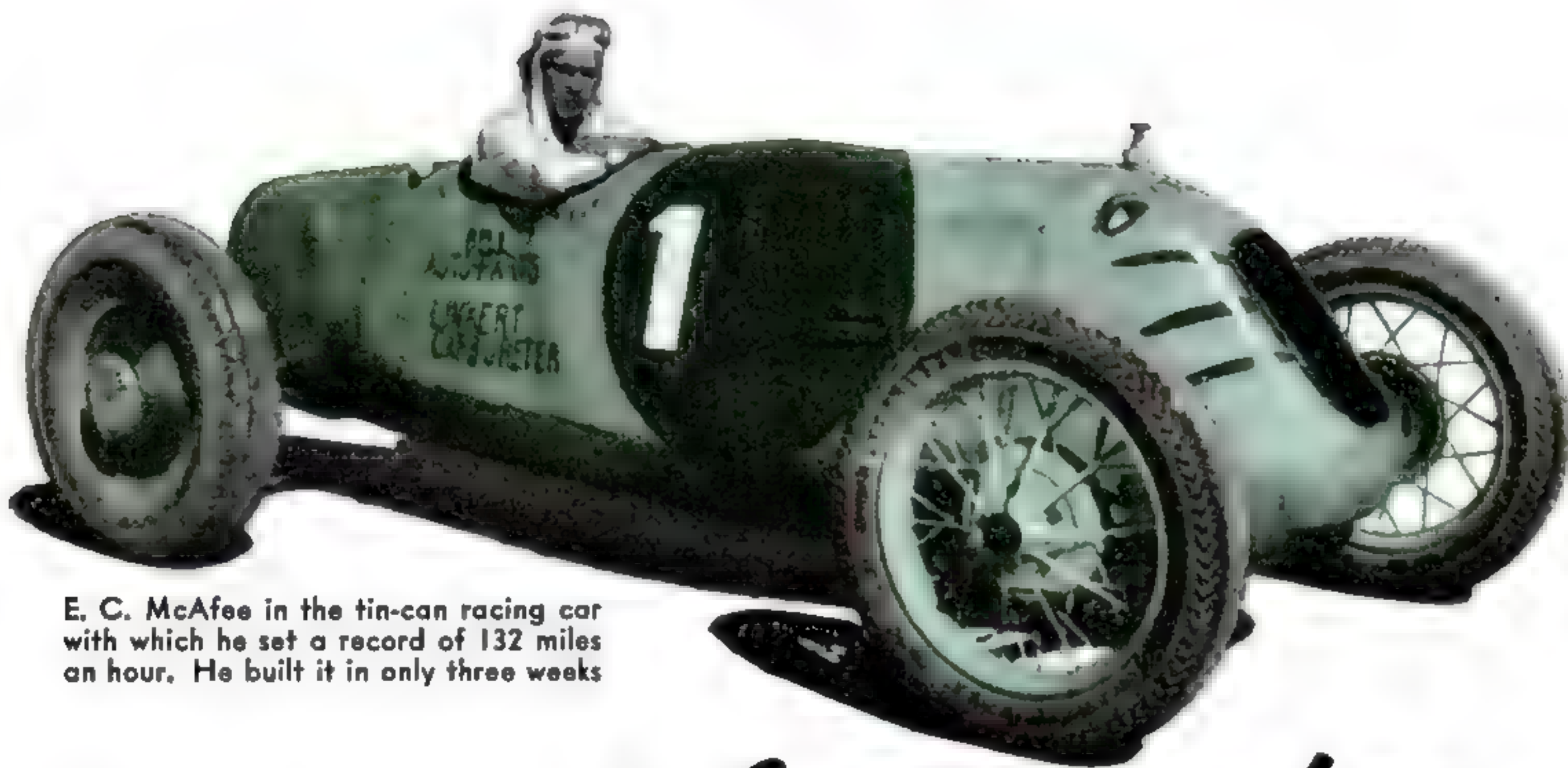
INSTEAD of trudging over their long suburban beats, policemen of Inglewood, Calif., now whiz along at thirty miles an hour on motor scooters. Economical to operate, the diminutive machines travel as far as 130 miles on a gallon of gas. To increase their usefulness, some of them have been fitted with miniature side cars to match.

Big Instrument Board Checks Plane's Performance



In flight tests, four engineers were needed to watch all the instruments

EIGHTY take-offs and landings, 5,000 miles of flying, and 450 miles of taxiing have just proved the airworthiness of the world's biggest passenger plane—first of a fleet of six for the Pan American Airways. For the tests, the seventy-four-passenger Boeing was transformed into a flying laboratory. A special instrument board kept as many as four flight engineers busy, two of them calling off readings at various speeds and altitudes while the other two jotted them down. The instruments included a bank of mercury tubes showing the air pressure at twenty-six places on the plane, and thermometers registering motor and other temperatures at sixty-one points.



E. C. McAfee in the tin-can racing car with which he set a record of 132 miles an hour. He built it in only three weeks

100-MILE-
AN-HOUR

JALLOPIES

RACE ON THE DESERT



BELL
AUTO-PARTS

There isn't room in the tiny cockpit for a wheel, so two handles are attached to the post for steering

Although it isn't much for looks, this four-cylinder Model B Ford, with a special valve-and-head job, made 100.96 miles an hour

STREAKING through the hot, alkali dust of Muroc Dry Lake, in the Mohave Desert, a tiny, buglike racing car snapped a wire stretched across its course. A quarter mile farther on, it hurtled into another wire. When judges consulted the electric timing apparatus, they announced that E. C. McAfee, piloting the diminutive speedster, had hit a speed of 127.60 miles an hour—setting a new record for the tin-can racers that compete in the strange and thrilling amateur speed meets held by



the Southern California Timing Association.

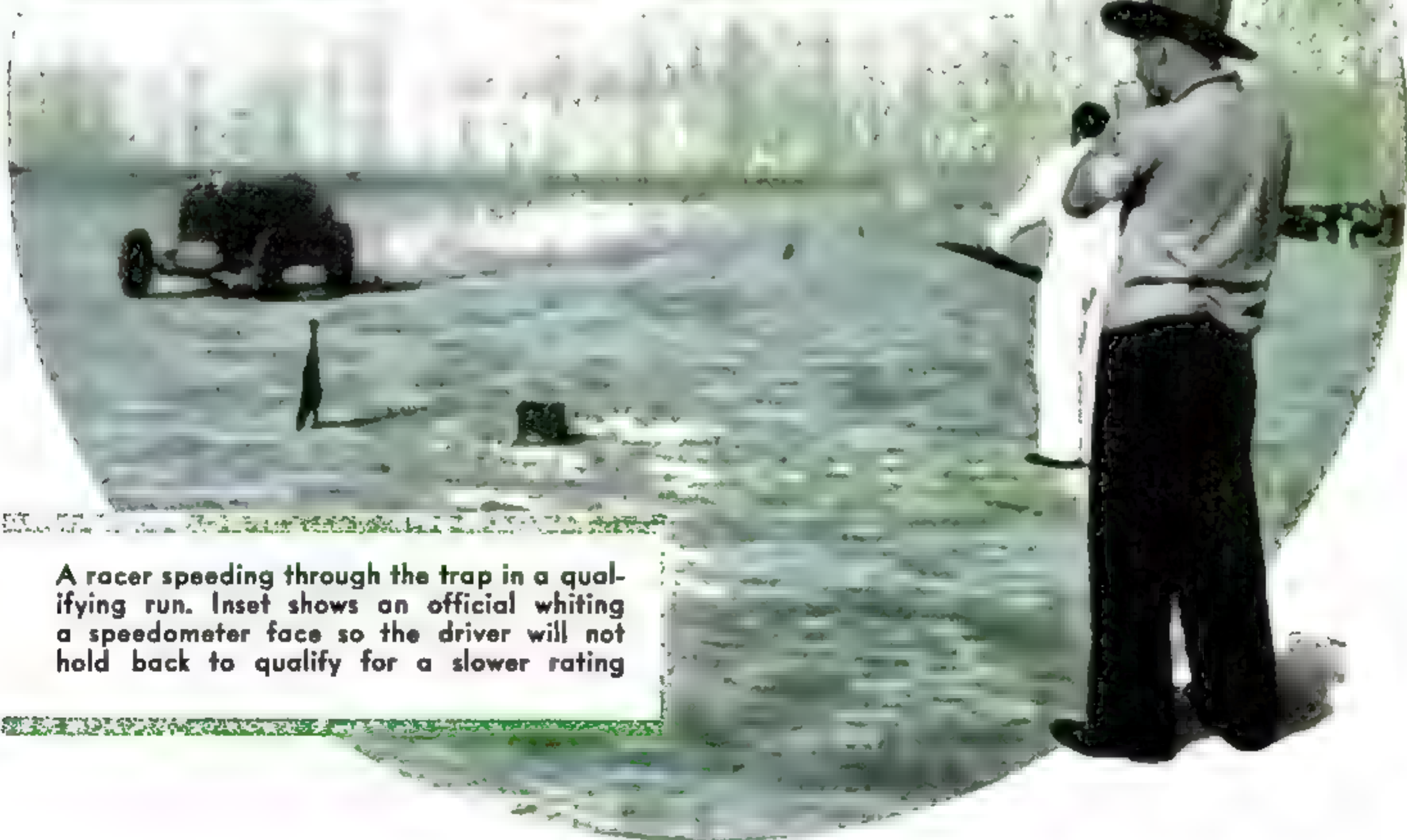
Three weeks before, McAfee's car had been only a mass of tubing and the block of an untried four-cylinder stock motor sitting on a garage floor. Hours of spare-time work had transformed it into a streamline racer which now carried off highest honors in a hotly contested tournament of thrills.

But young McAfee was not satisfied. Before the next race day arrived, he applied the shears and cut another hole through

the cowl to cool the engine some more. Then on the cracked surface of Harper's Dry Lake, he pointed the rounded nose of his homemade car down the straightaway. The starter's red flag dropped; wheels bit into the bone-dry earth, and electrical timing devices recorded the almost incredible speed of 132 miles an hour as the home-built jalopy skimmed through the measured quarter mile.

McAfee's car, on whose side blazes the number "1" as testimony that he has qualified at a higher speed than any other of the 200 members of the association, was built of stainless-steel tubes

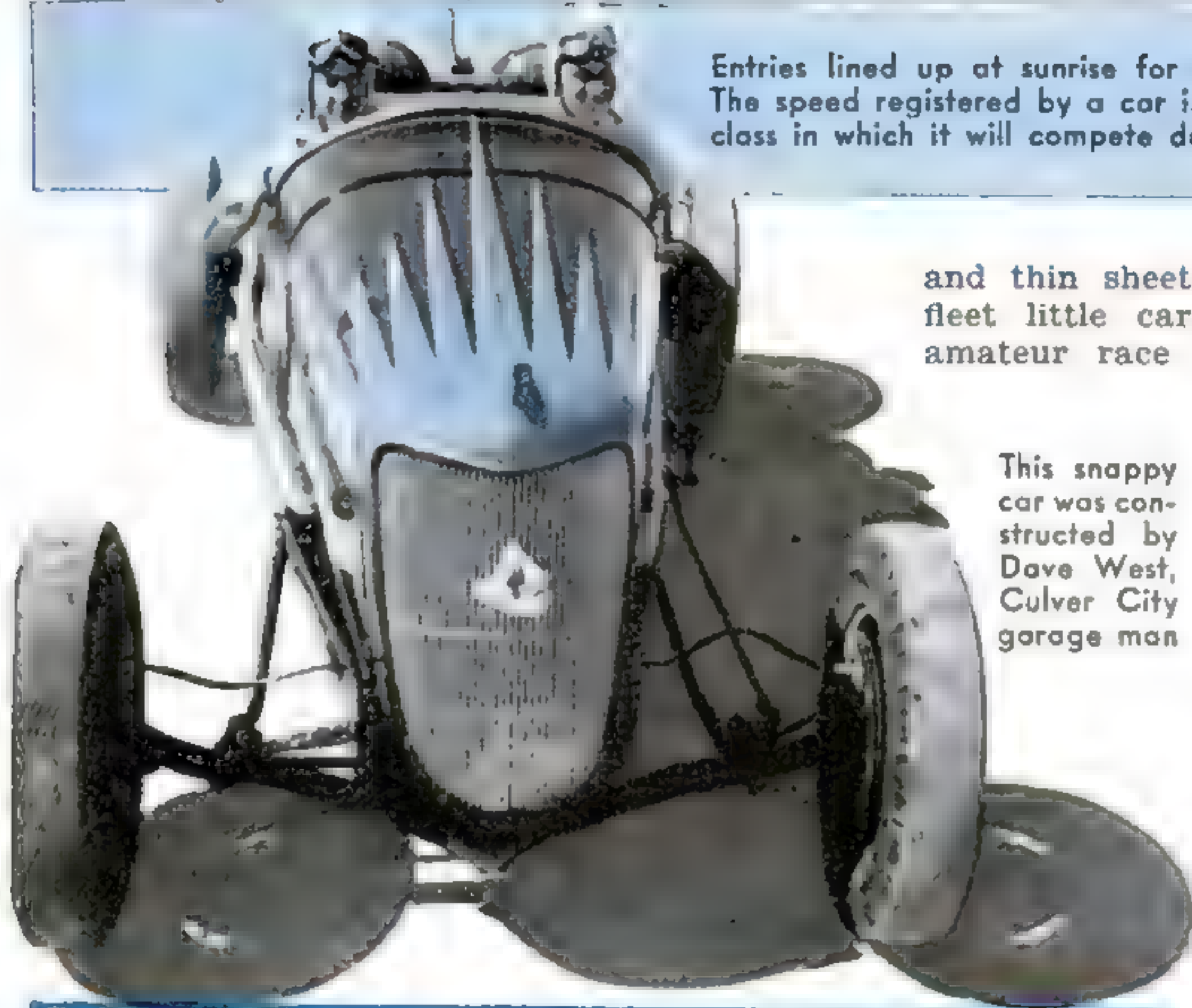
By
**HENRY F.
UNGER**



A racer speeding through the trap in a qualifying run. Inset shows an official whiting a speedometer face so the driver will not hold back to qualify for a slower rating



Entries lined up at sunrise for the qualifying trial runs. The speed registered by a car in this test determines the class in which it will compete during the afternoon races



This snappy car was constructed by Dave West, Culver City garage man

and thin sheets of metal. Some of the fleet little cars that compete in these amateur race meets are beautiful creations of master garage craftsmen, but most of them are small roadsters and modified coupes, fitted with a variety of devices intended to push the cars above the 100-mile-an-hour mark.

These speed dashes, held on dry lakes of the Mohave Desert in southern California, have no counterpart anywhere in the world. No money purses lure the contestants. Free regrinding jobs and coveralls, awarded by supply firms, are the only prizes they can expect for setting new records or for winning mile-long races down a flag-marked straightaway. Yet no driver at the classic Indianapolis sweepstakes ever strove harder to win than do these mechanics and service-sta-



Long exhaust pipes rigged along the sides of some cars, as at the left, reduce the danger of fires being started by hot gas

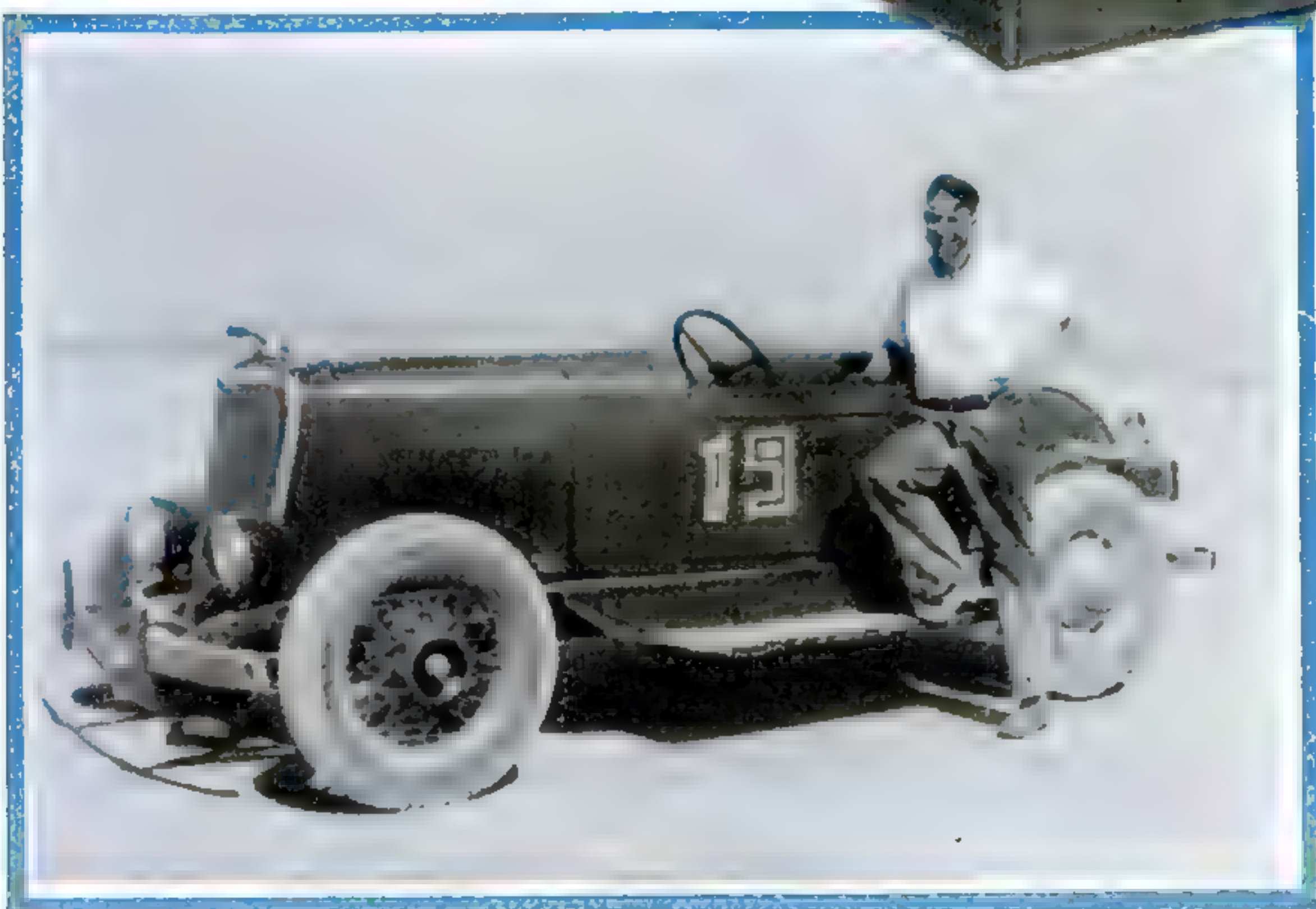
tion workers who "hit the desert" four times each year to drive through scorching heat and blinding dust in quest of new records.

It's all very official and accurate, too. Twenty-eight clubs form the association. Between dusk and midnight of a Saturday night, each club will rendezvous somewhere near Los Angeles. Night Flyers meet outside Pasadena; the Gophers on another side road; Mercuries, Sidewinders, Comets, 90-Mile-An-Hour entries, Idlers, and Road Runners form their own parties. Some of the racers are driven; others are towed, and a few ride on trucks. Through the night these strange caravans move along the highway through San Bernardino, Victorville, Barstow, and on to Muroc or Harper Dry Lake.

Through early morning hours, the technical committee labors to install the electrical timing system. A quarter mile apart to the inch, two wires stretch across the course, each leading to a recording disk at the judges' stand, which consists simply of an overturned airplane motor crate and an umbrella. At dawn, the first driver to arrive on the starting line gets the "Go!" signal. He may drift past the starter at forty miles an hour, or leap forward from a standing start, helped by five or six bystanders eager

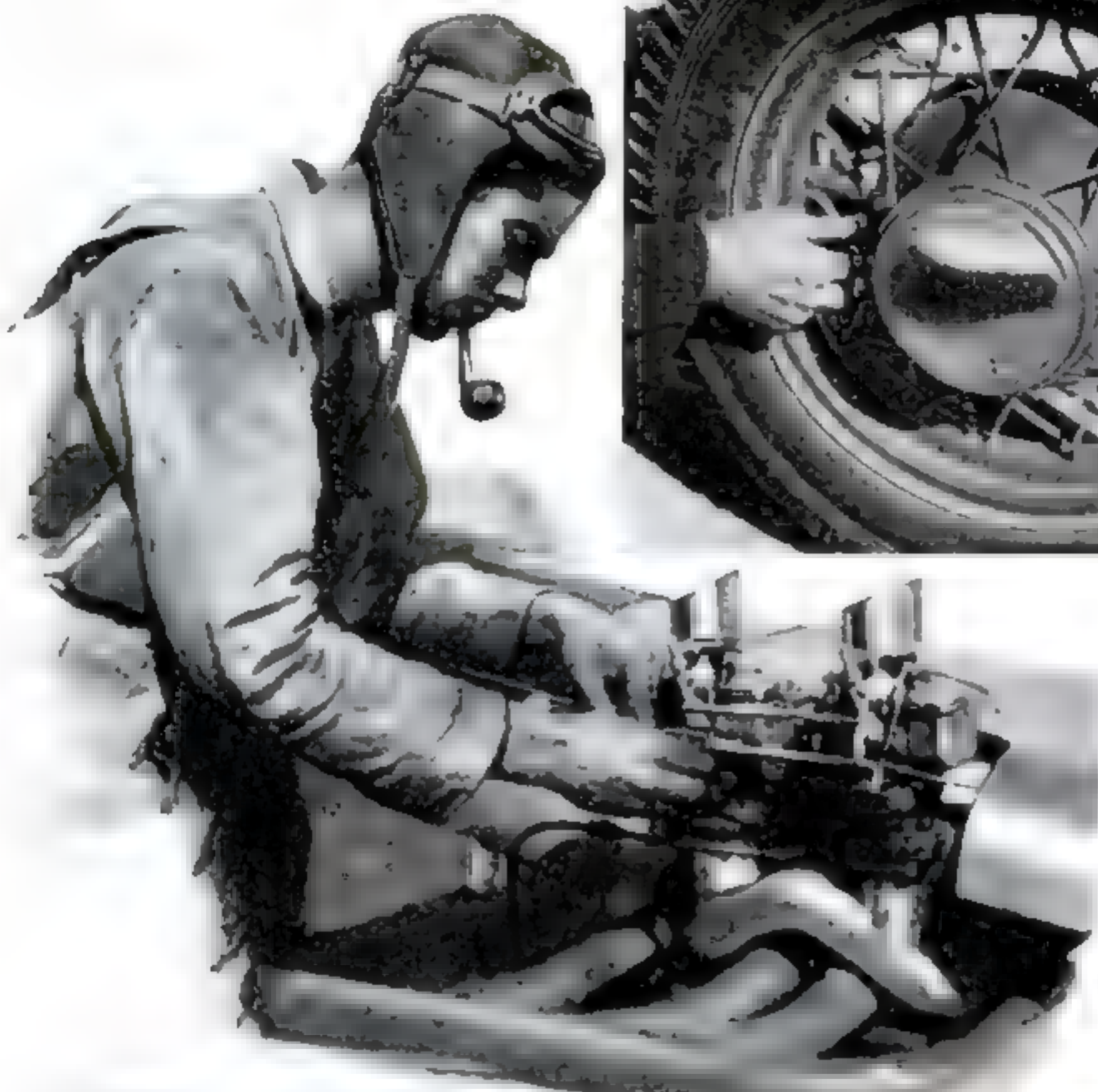


The judges' stand is just an overturned airplane-motor crate with a rough desk and stools set on it



It was considered quite an achievement to coax 86.43 miles an hour out of this four-cylinder Chevrolet of 1927.

At the right, lead coils are being wound around the spokes of a wheel to balance weight



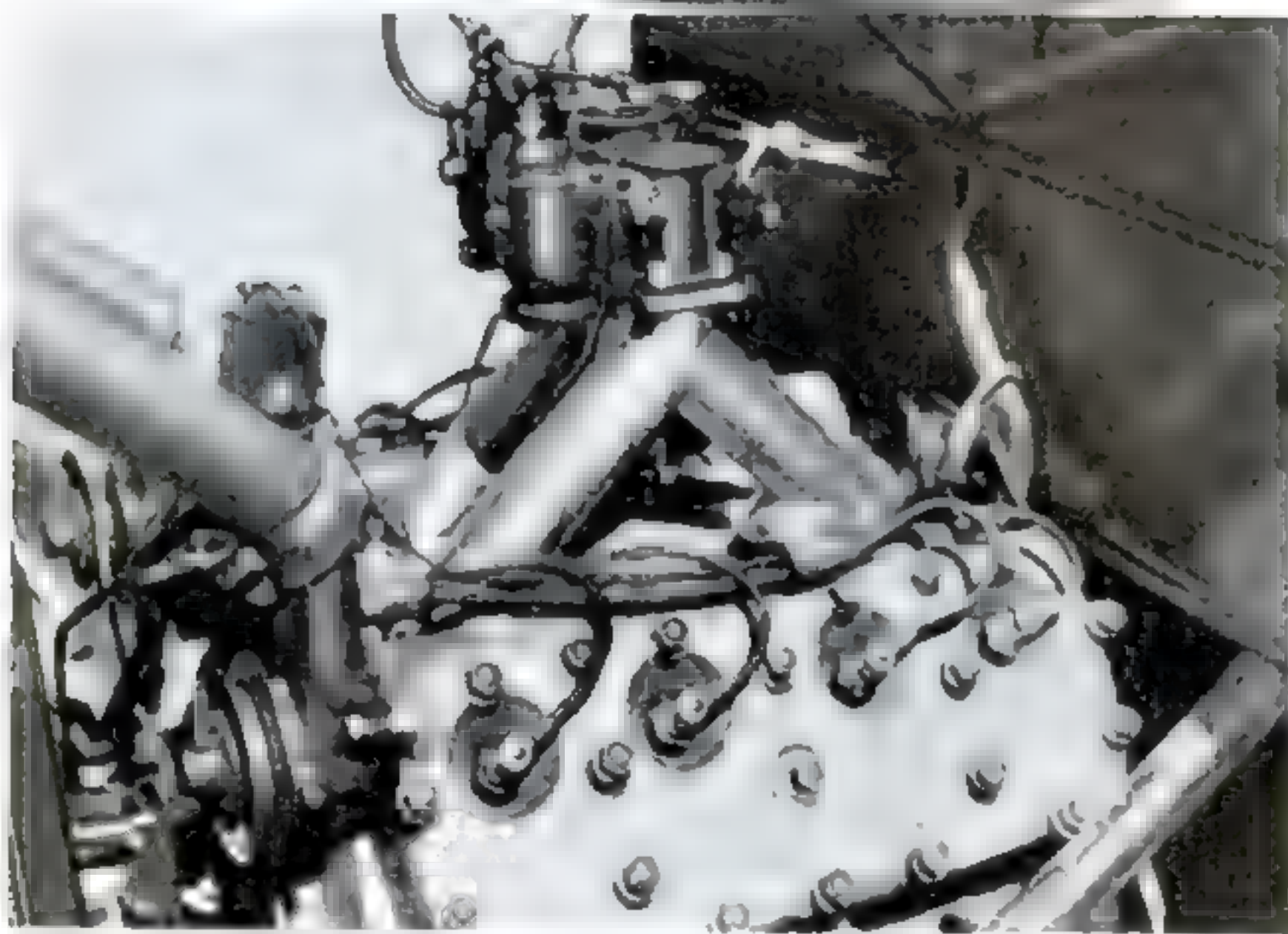
drive at top speed, to qualify for races which take place during the afternoon. To make sure that none eases up on the throttle to qualify for a slower class, an official smears whiting over the faces of the speedometer and the tachometer, the instrument that shows motor speed.

As I stood beside the judges' stand recently, observing the trials, I noted that few failed to pass the 100-mile-an-hour mark. Disap-

pointment was registered on alkali-crusted faces behind wheels which had steered occasional cars through somewhere in the nineties. Back went those drivers for another try.

You hear strange arguments about the respective merits of flat heads, Crager heads, three-port heads, Winfield heads, V-8 heads, Tornado heads, McDowell heads, four-port heads. Each driver expresses his own preference. You find Ford Model B four-cylinder and V-8 motors, Chevrolets, Buicks, a Pierce Arrow, Terraplanes. Anything goes, with two exceptions. Drivers must race American production engines, and cannot use double overhead cam jobs.

Walk down the long line of cars awaiting their turns at the starting line, and you see twin carburetors projecting through the cowl- ing of one car; a single, long ex- haust pipe on another; four indi- vidual exhausts curving from a third; open roadsters and roadsters covered with canvas, with drivers' crash-helmeted heads projecting through small holes—this for streamlining; twin, staggered man- ifolds; lead coils on spokes to bal- ance wheels, helpers filling radi- ators from vacuum jugs of chilled



Staggered, inverted V-shaped manifolds distribute gas to the eight cylinders of this engine. Above, a driver adjusting his dual carburetors whose intakes protrude through the car's hood

water. Many ingenious methods and devices, all pointed toward greater speed.

to see each car turn its maximum speed. One mile away, he enters the trap, emerging as he flashes past the alert judges. On his return, a judge marks his speed on a small card attached to the left door of the car. Between sunup and noon, more than 400 trials will be run, one contestant moving down the straightaway as his predecessor disappears in a dust cloud down the narrow lane. Like jack rabbits, these boys jump toward the finish line. Each is expected to

Too, you hear well-nigh unbelievable tales of achievement; then you see those same incredible cars leap down the lake, and from the timers you hear of another record fall- ing. Dave West, a Culver City mechanic in No. 94, which means that ninety-three other cars are faster than his, fixes 100 miles an hour as his goal, and triumphantly demands that you "set down 113," a few minutes later,

POPULAR SCIENCE

on returning from his first trial spin. Official, too. Karl Orr spent \$900 on his four-cylinder motor, tinkering and improving. He was rewarded with 115 miles an hour. But W. C. Warth, with a much smaller investment, perhaps \$400, now jams the throttle down for 129.41 miles an hour.

Spider Smalley, one of the Pasadena Night Flyers, clocked 111 in a Ford roadster. Spider installed a 1932 Model B Ford motor in a 1929 chassis. He bought overhead valves, a large carburetor and manifold, and reground the cams—"There's the secret," he whispers. He installed racing bearings and high-duty, high-dome aluminum-alloy pistons and changed to 3.27-1 gearing. And, as a result, he had a mechanical jack rabbit capable of wind-splitting speed.

Glenn Stone and Brooks Walling of the Hot Iron club at Canoga Park put together a '29 roadster chassis and a '32 engine block. Except for pistons and a new truck crankshaft, these boys picked up discarded parts. They pushed their jallopy up to 108.43 miles an hour. Bob Cressey and Al Brush owned a motor and chassis, respectively. They combined the best features of both, and rang up 101 before modifying the body for increased speed.

There's the real secret of the fascination of this strange sport—unlimited enthusiasm and decidedly limited pocketbooks. Money and time are spent with no hope for material rewards. On the side lines you hear the boys arguing about power outputs, reduced cam action, tachometer readings. One motor winds up 6,300 r.p.m., another 5,800, yet the slower engine produces a winner. You can be sure that new gears and faster-acting cams will spell a different result at the next meeting of the association.

Meetings are held on Sundays during the summer only, because winter weather leaves the old lake beds in a soggy condition. Owing to the shortness of the run, most drivers remove their fan felts, thereby disconnecting water pumps and generators. All unnecessary trimmings, such as fenders, bumpers, windshields, and spare tires are eliminated, to lighten the cars and enable them to turn up maximum speed. In a phaeton, the back seat is covered with a tonneau shield, usually of canvas, to give a streamline effect and

prevent eddies of air that would hold the racer back.

At early meetings, coupes and sedans appeared among the entries, but it was soon found that these could not keep pace with open cars. Although a few of the more fortunate drivers are equipped with crash helmets, the majority of them content themselves with leather headgear and goggles.

Afternoon races provide an exciting climax to the trials, but these form a less important part of the lake runs. Three and four abreast, the little cars roar through the dust. Occasionally, one smashes into the crowd. It was Smalley, blinded by dust, whose ignition cut out while following the leaders at a clip passing the hundred mark. "She blew up," he tells you. "What's a guy to do? Spin her! At seventy, I slithered between two parked cars while hot water poured back through the fire wall." But that doesn't happen very often. Just frequently enough to bring crowds of 15,000 to some of the trials, which are held secretly in order to discourage even larger gatherings at these nerve-tingling race meets behind the hills fringing the Mohave Desert.



Latest in streamlining—a driver's head, topped with a crash helmet, sticks up through a canvas sheathing



On the hot, dry desert, racers fill their radiators with ice water from large vacuum jugs



They Remember Dates for You

REMEMBERING for other people is the odd business conducted by three enterprising young men in Chicago, Ill. Soliciting trade from those who habitually forget their wedding anniversary, mother-in-law's birthday, and other important dates, the memory trio will remind any customer by telephone or letter of any eight future events he may name, for a fee of \$1.50 a year. Presumably, they also remind you to renew your contract with them when it lapses—free of charge.

These young men remind you—if you don't forget to tell them in advance

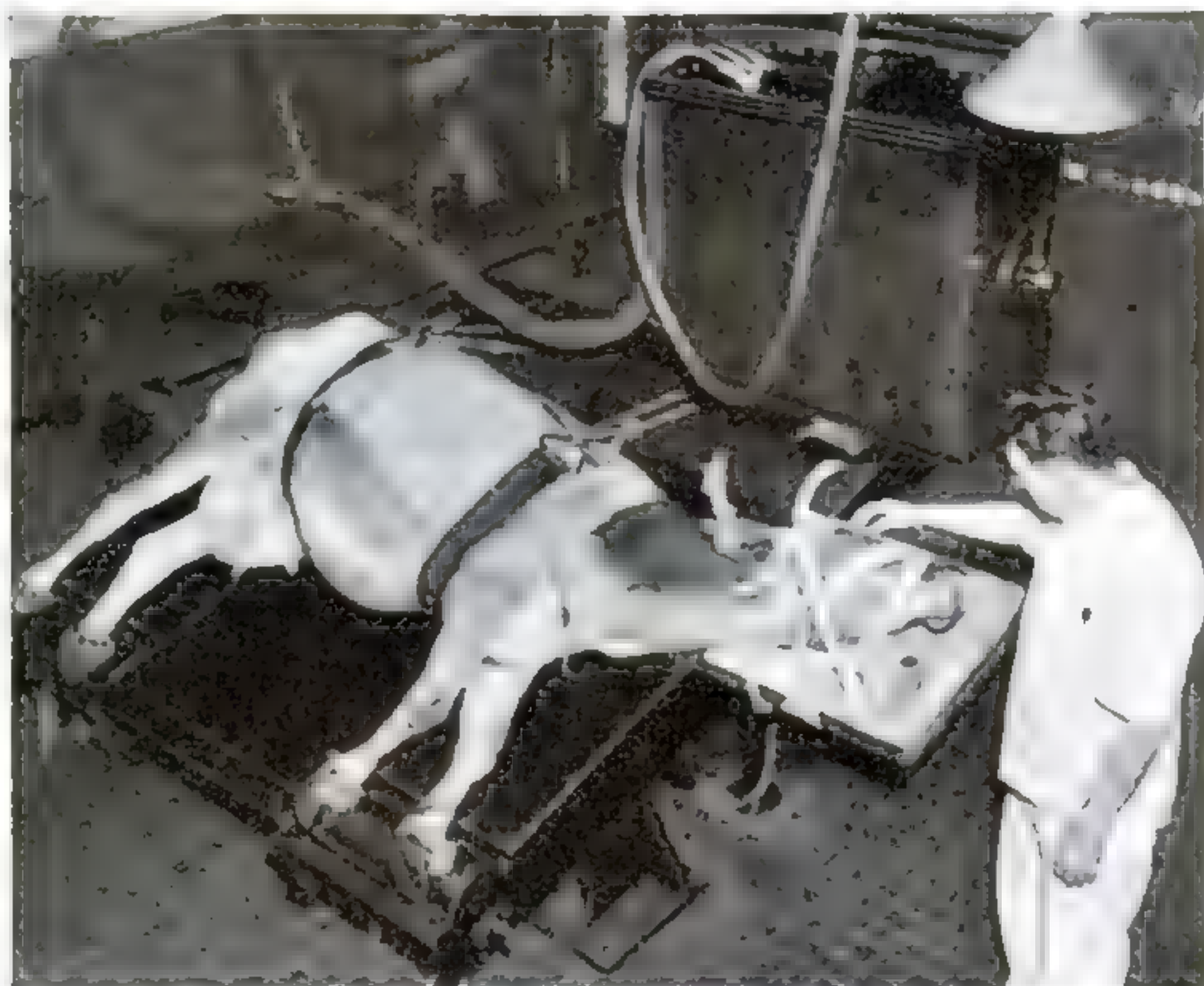


Squeegee Mop Washes Floors

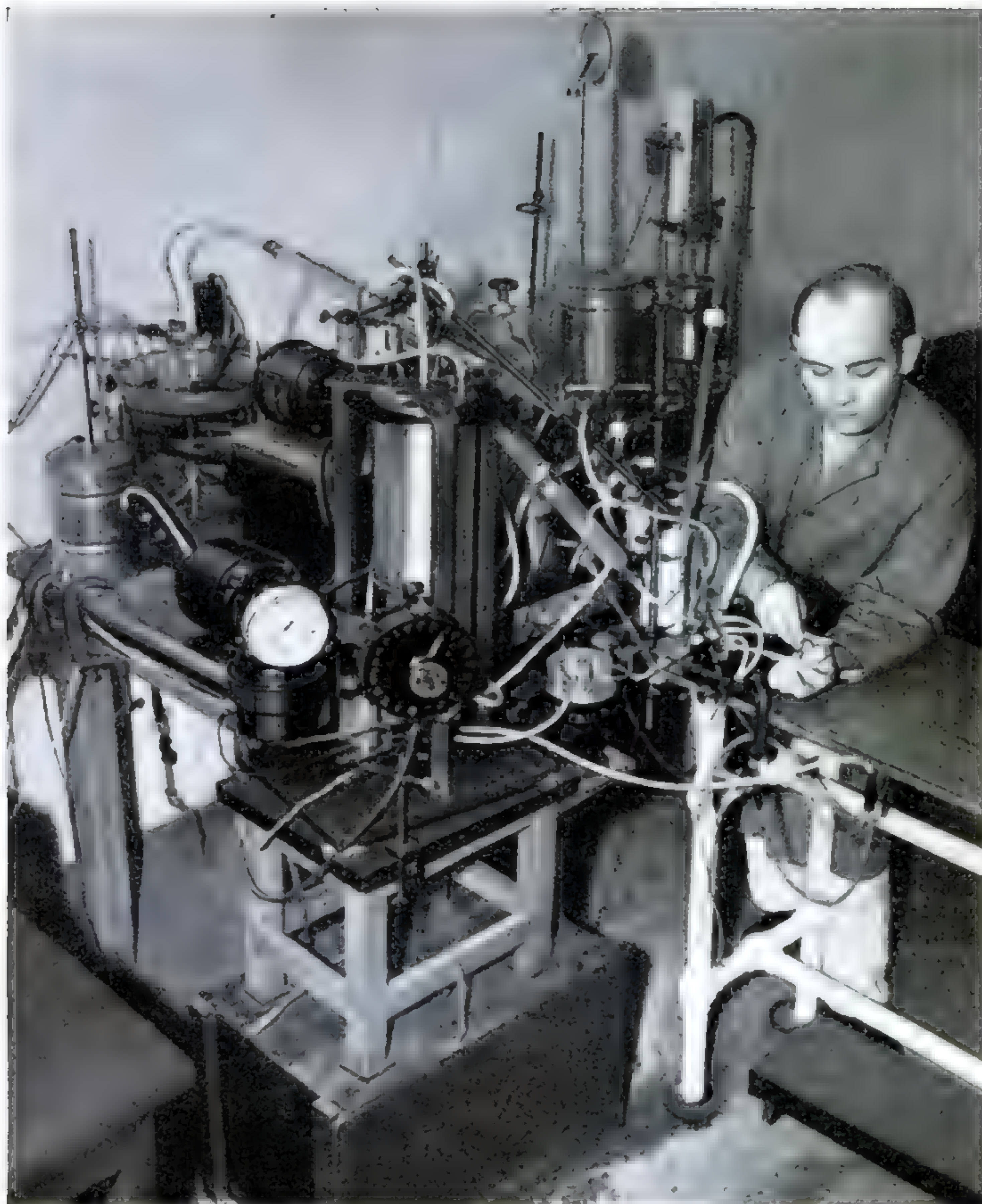
CURVED so that it collects the water and cleaning solution used in washing a floor, a new-type squeegee washes the surface and then dries it. Pushed over a floor, it holds the cleaning materials within its curve, while its rubber edge scrapes the moisture from the floor and leaves it dry and clean.

Mammoth X-Ray Machine Treats Animals

WHAT is believed to be the largest X-ray machine ever designed exclusively for use with animal patients is now in service at the veterinary hospital of the University of Pennsylvania in Philadelphia. Suspended from a ceiling crane so that it can be moved to any part of the room, the 800-pound apparatus utilizes a current of 200,000 volts. Technicians control the powerful radiations from a lead-lined control booth while observing an animal patient through a glass window in the foot-thick concrete wall of the X-ray room.



A patient ready for treatment with the huge X-ray machine for animals



Machine Pinch-Hits for Heart and Lungs

WHAT looks like a hodgepodge of cylinders, glass tubes, and dials in the photograph above may soon be saving lives in hospital operating rooms. Perfected by Dr. John H. Gibbon, Jr., fellow in the school of surgical research at the University of Pennsylvania, the apparatus is a combination

mechanical heart and lungs which has pumped blood and breathed air for extended periods for cats whose hearts and lungs had been temporarily short-circuited surgically. The mechanism may prove of inestimable value in human surgery by pinch-hitting for a patient's heart and lungs during delicate operations.

Air-Pocket Pack Opens Parachute Automatically

YANKING a rip cord, which sometimes taxes the self-control of nervous novice parachute jumpers, is not necessary with a new automatic 'chute demonstrated recently by a professional parachute jumper for its inventor, Richard H. Hart, of New Orleans, La. As the jumper falls, the parachute pack swings up over his head, where an air pocket bellows out and pulls the rip cord to open the 'chute. Another feature is a pair of steering flaps controlled by special shrouds, by which the parachute may be maneuvered during a descent. This feature is said to give a slower rate of descent. The new 'chute can also be opened manually for delayed opening.



Jumper maneuvering the new self-opening parachute with flaps controlled by shrouds

Richard H. Hart, the inventor, points to the air pocket on the pack which catches air and opens the parachute

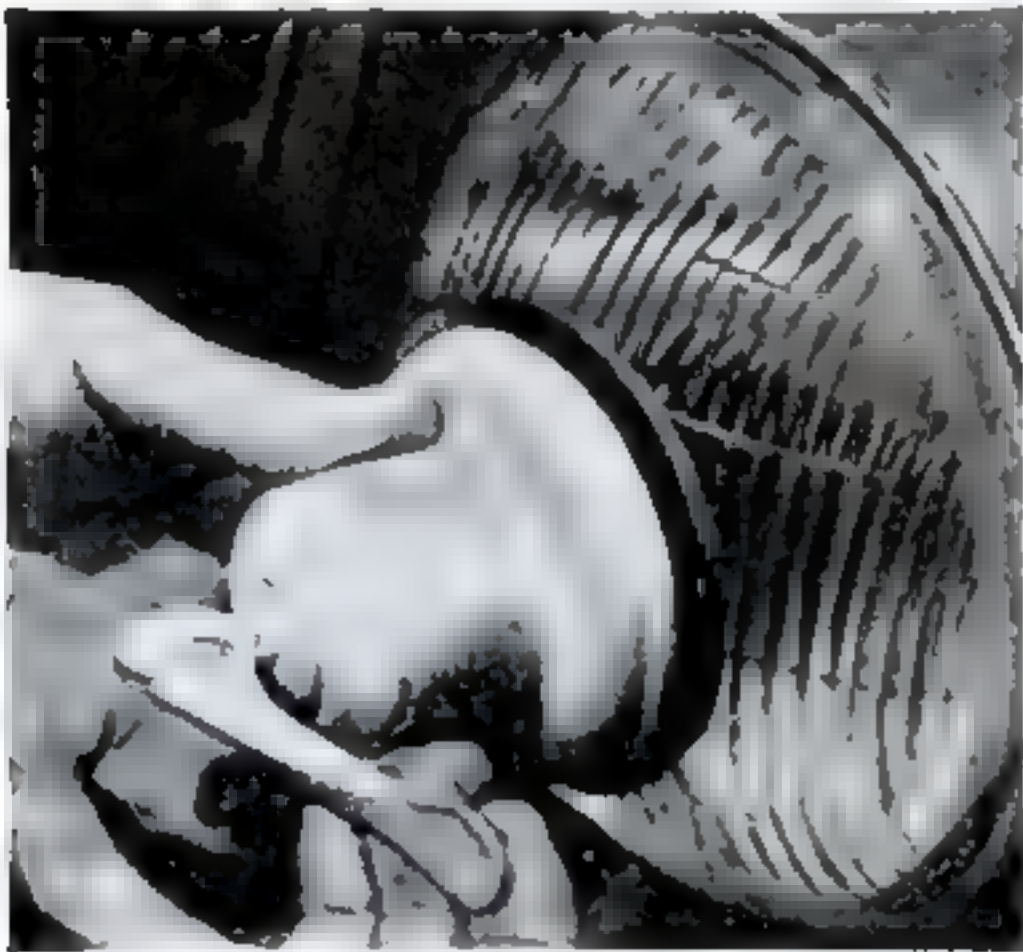


Extra Handlebar Rests Cyclist

A SUPPLEMENTARY handlebar in the form of a curved T is one of the features of the French bicycle pictured at the right. The spare handlebar permits the cyclist to change his posture to avoid the fatigue of a single riding position.

Vacuum-Cup Tool Removes Lenses

SUCTION is mechanically produced in a new vacuum-cup tool for aiding the safe removal of frameless lenses from automobile headlights. Pumping the small handle built into the unit creates a suction said to be much stronger than that obtained with conventional vacuum cups.



Pumping the small handle creates suction to give a good grip on the lens



To rest his back, a cyclist uses the T-shape auxiliary handlebar



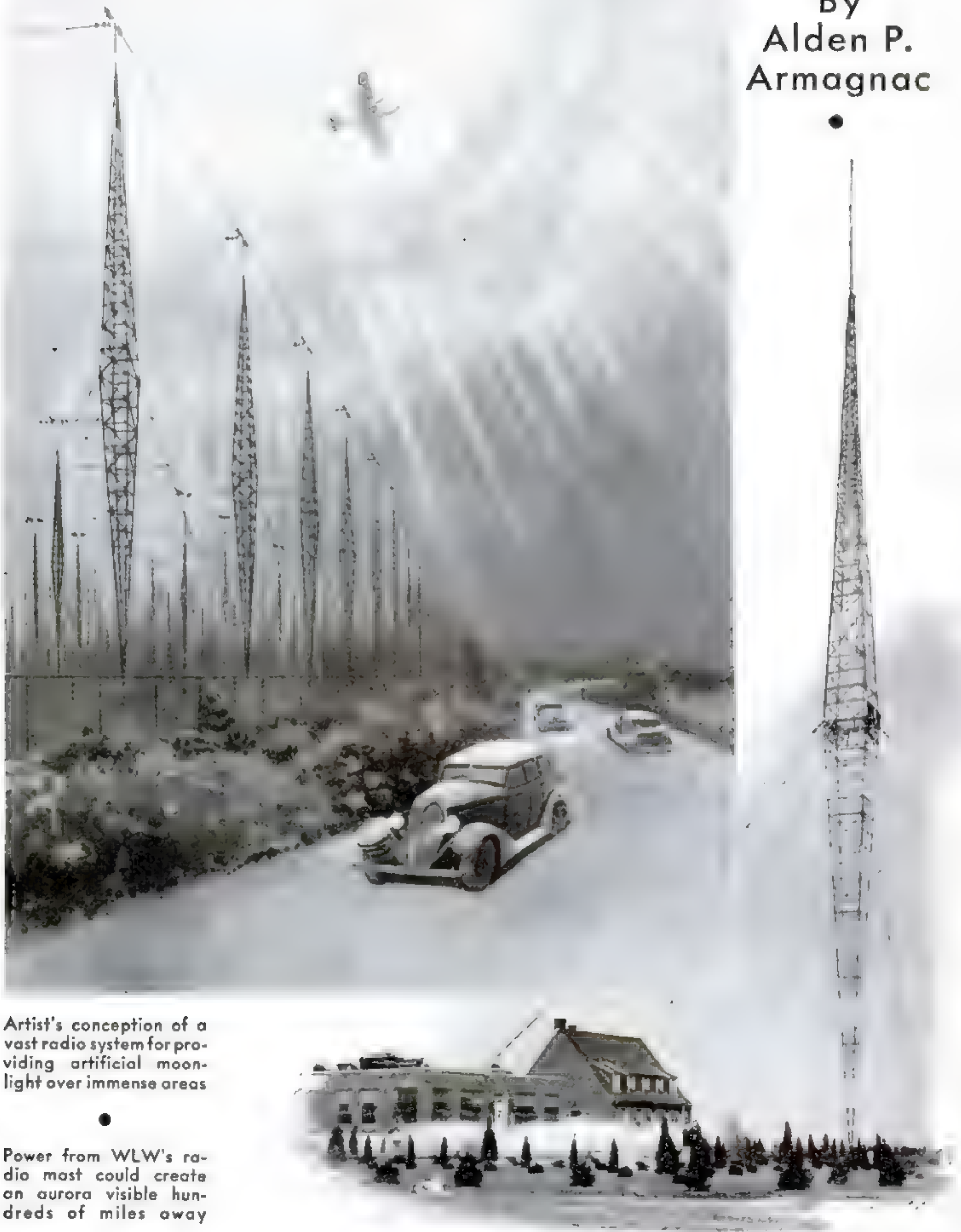
This car tag warns other motorists that a beginner is at the wheel

License Tag for Novice Drivers

IN THE interest of traffic safety, the Cleveland, Ohio, Automobile Club is sponsoring special license-plate tags for novice drivers and persons just learning the fundamentals of automobile operation. Experienced motorists, it is believed, will take extra precautions and give a wide berth to cars bearing the signs indicating that they are operated by beginners. In the photograph at the left, John L. Young, director of the Cleveland Club and originator of the idea, is examining a new-driver plate.

Moonlight from

By
Alden P.
Armagnac



Artist's conception of a vast radio system for providing artificial moonlight over immense areas

Power from WLW's radio mast could create an aurora visible hundreds of miles away

Radio Waves

ARTIFICIAL NORTHERN LIGHTS TO TURN NIGHT INTO DAY

WILL we light the highways of the future with artificial auroras in the night sky? Not only is the idea feasible in theory, but it could actually be tried out with apparatus now available, according to Prof. V. A. Bailey, of the University of Sydney, Australia.

His startling plan calls for hurling a vertical beam of enormously powerful radio waves to a height of fifty miles or more. Under their bombardment, the thin air of the upper atmosphere would shimmer with the bluish or greenish light of the aurora, just as radio waves make tubes of rarefied gases glow in the laboratory. A whole countryside could be flooded so brilliantly with this man-made moonlight, the Australian physicist declares, that street lighting no longer would be necessary for the safety of motorists and pedestrians.

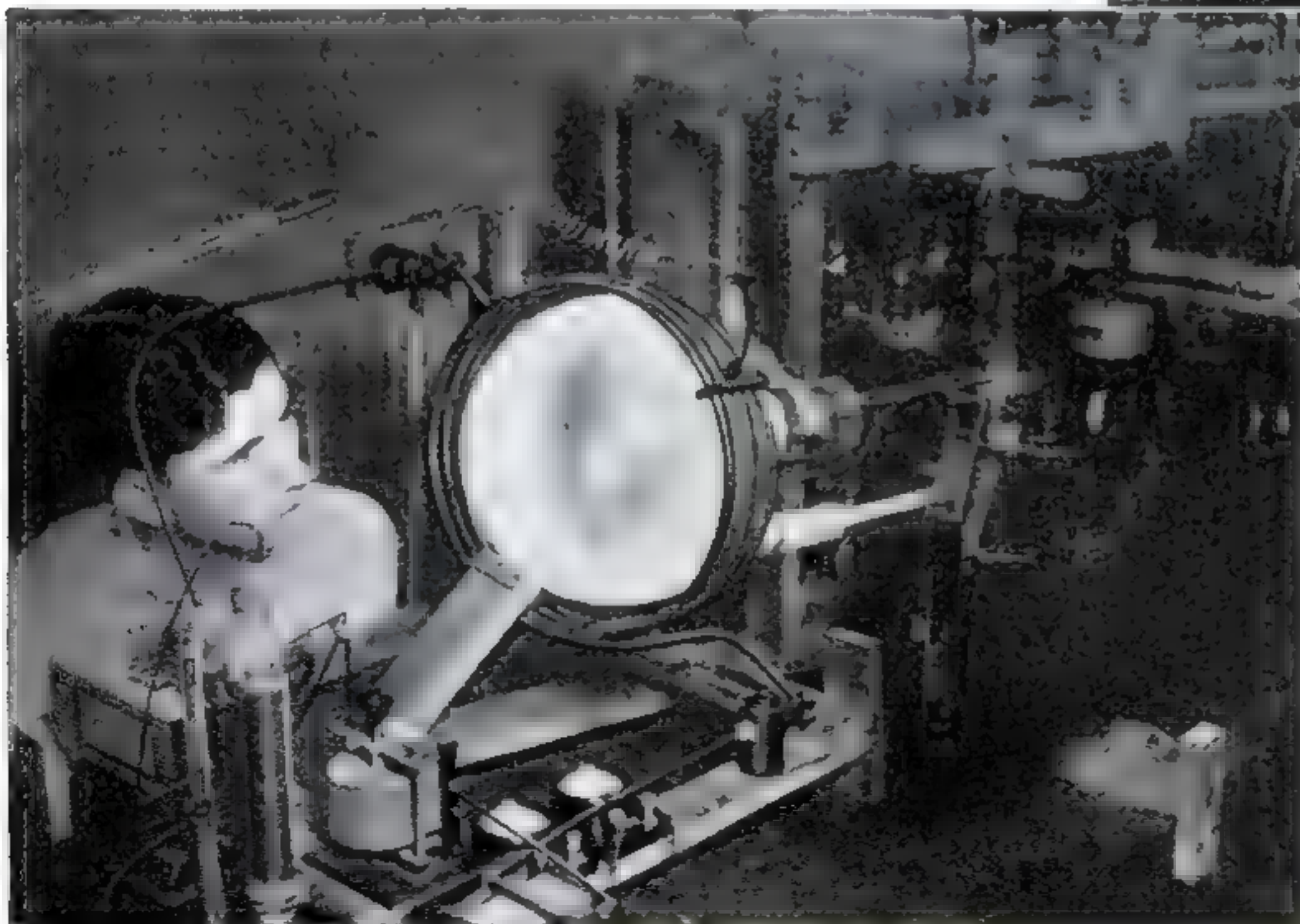
Both station WLW, in Cincinnati, Ohio, and another high-power station in Moscow, Russia, have the 500-kilowatt capacity needed to test the scheme, Professor Bailey points out. The remaining requirement would be a special aerial system consisting of 800 individual antennas suspended horizontally at a height equal to just half of their 328-foot length, and forming a huge grid or checkerboard pattern a mile and a quarter square. With this apparatus, radio engineers could produce in the sky a synthetic "moon" or circular aurora that would be visible hundreds of miles away.



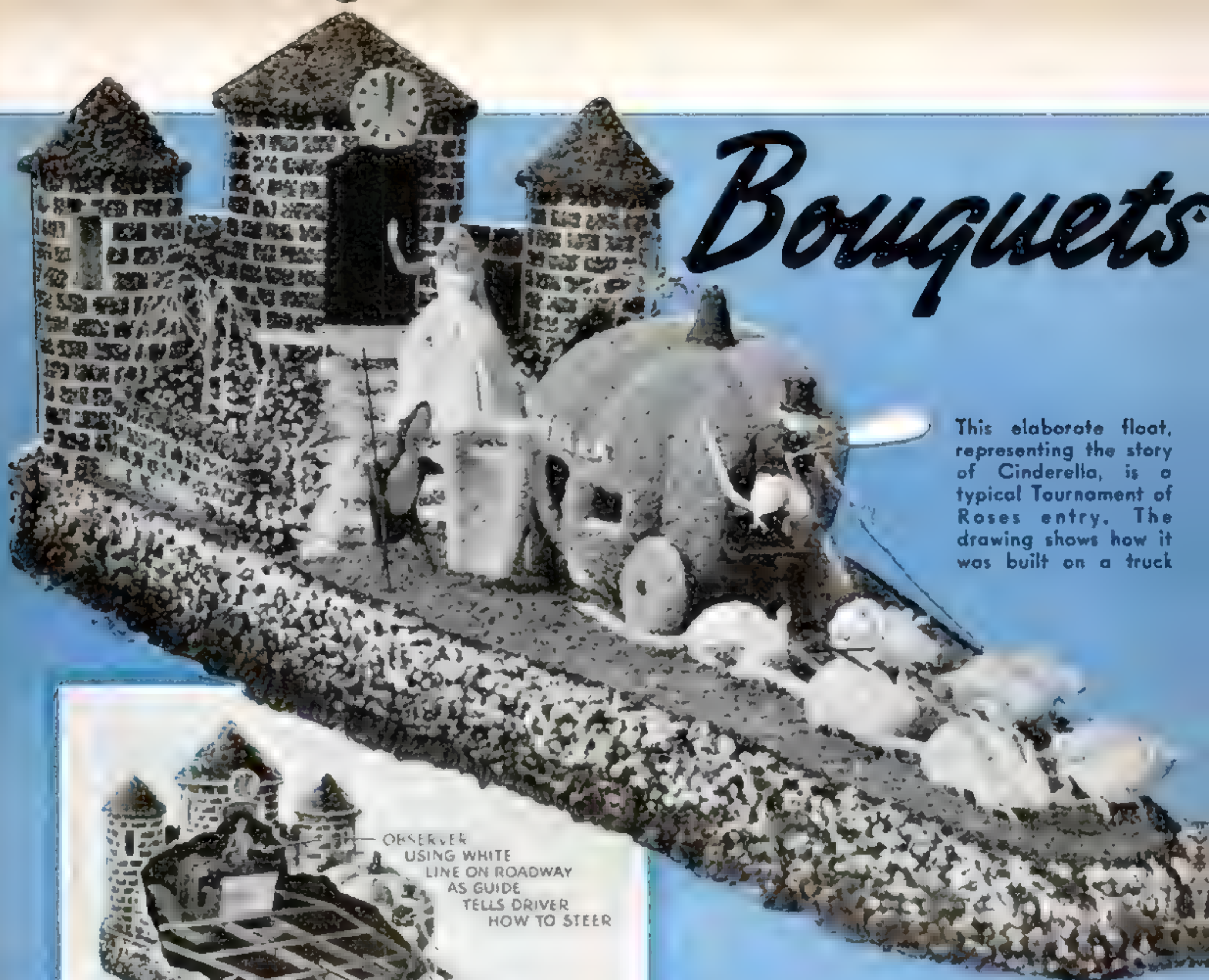
How the system works, shown by a lamp bulb held in radio-wave field to make it glow



The entire output of WLW's 500 kilowatts, strong enough for the "aurora" tests, is concentrated in this arc



Radio waves from the coil make the gas in this tube glow. The same principle forms the basis of the proposed man-made moonlight



Bouquets

This elaborate float, representing the story of Cinderella, is a typical Tournament of Roses entry. The drawing shows how it was built on a truck



A metal brace being welded into place to strengthen a float. Last-minute jobs like this are often necessary after the covering of flowers has been applied, to make the structure more rigid

ON THE last day of the year, 100 automobiles and trucks stand in garages and workshops, covered with skeleton frameworks of wood, steel, and wire. Twelve hours later they converge upon Pasadena, Calif., their intricate designs covered by 10,000,000 flowers gathered the day before by an army of workers in the fields. Overnight, 1,500 men and women have painted the vehicles with flowers, and the annual Tournament of Roses is ready to thrill the 1,500,000 spectators who visit the city on New Year's Day.

An intricately patterned float will take 400,000 blooms, fastened on wood, wire, and paper with glue, hairpins, and nails. It has its beginning as a model scarcely larger than a child's toy, built to scale and covered with fresh blossoms exactly as its larger counterpart will appear weeks later. Small floats employ

on Wheels

By
ROBERT E. MARTIN

The floral clock appropriately points to midnight as these workers prepare an exhibit for the Tournament of Roses. They are trimming flower stems evenly



Rear view of the Cinderella float, with a tableau of the slipper episode. The brick walls are composed of tens of thousands of red and white blossoms. Below is a floral merry-go-round which revolves around a central pedestal mounted on a small automobile





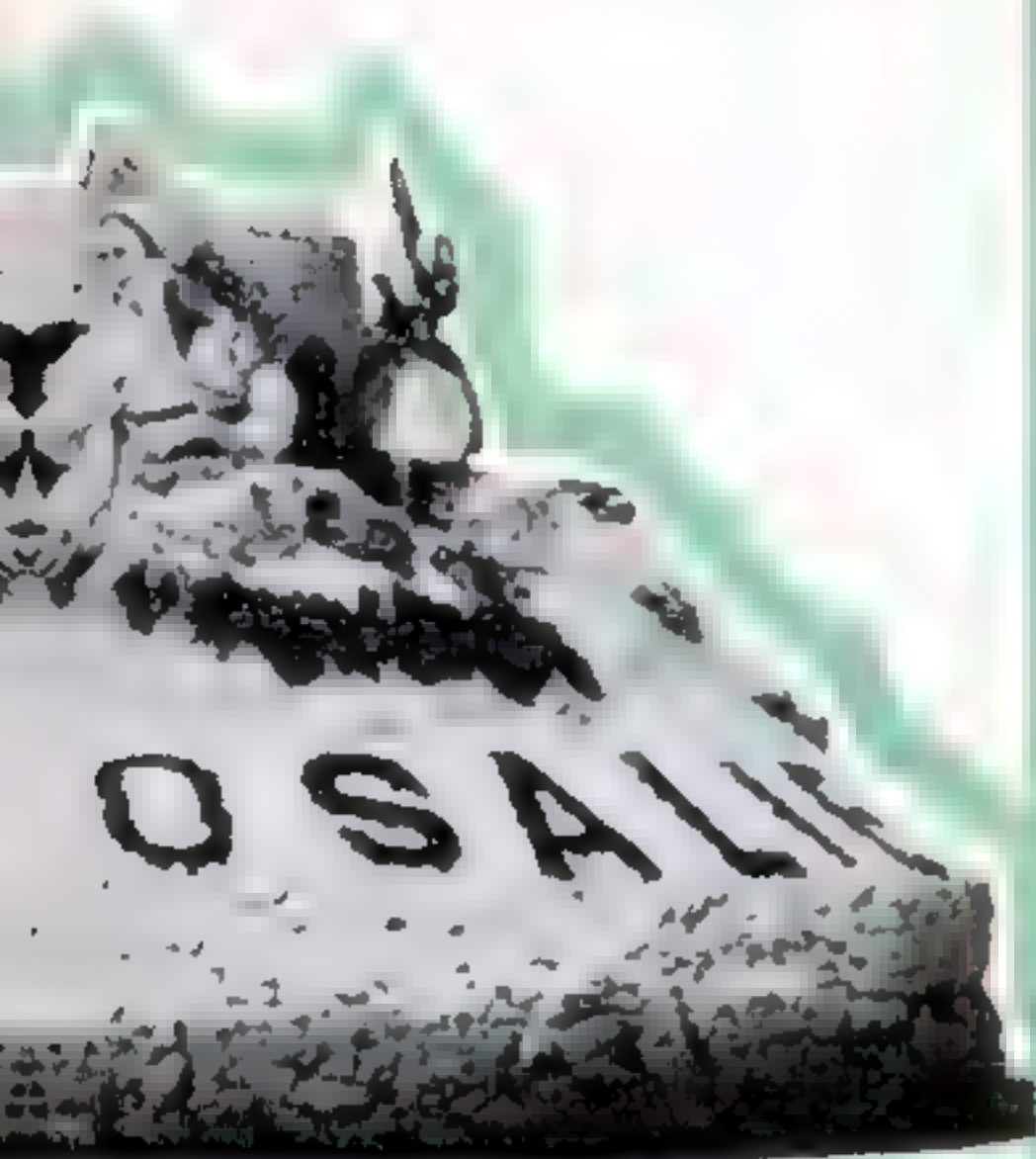
A figure being covered with flowers. The picture at top of page shows the preliminary model of a float. Dolls replace human figures

passenger cars, while the larger displays, some fifty feet long, are built on truck bodies. In the parade the trucks move backward, the drivers guided by assistants who peep through small holes at a line painted down the center of the street.

In starting construction, a wooden framework reinforced by iron bars is built over the vehicle, with the contours of the finished float roughly indicated. This cagelike frame covers the entire machine. Next, chicken wire is fastened to the frame, and arches and steps are reinforced with iron bars. When completed, the frame is stained green to hide it beneath the foliage covering. Moss pads or pasted newspaper sheets, and sometimes plywood, cover the framework, and on these the flowers are fastened.

In late afternoon of December thirty-first, a hundred or more groups of workers begin the final assembly, separating the thousands of bundles of flowers and placing them on the floats. Here they follow painted patterns, gluing white flowers on white areas, red flowers on red. Throughout New Year's Eve they work, weaving the blooms into the myriad intricate forms which give the completed displays their grace and beauty.

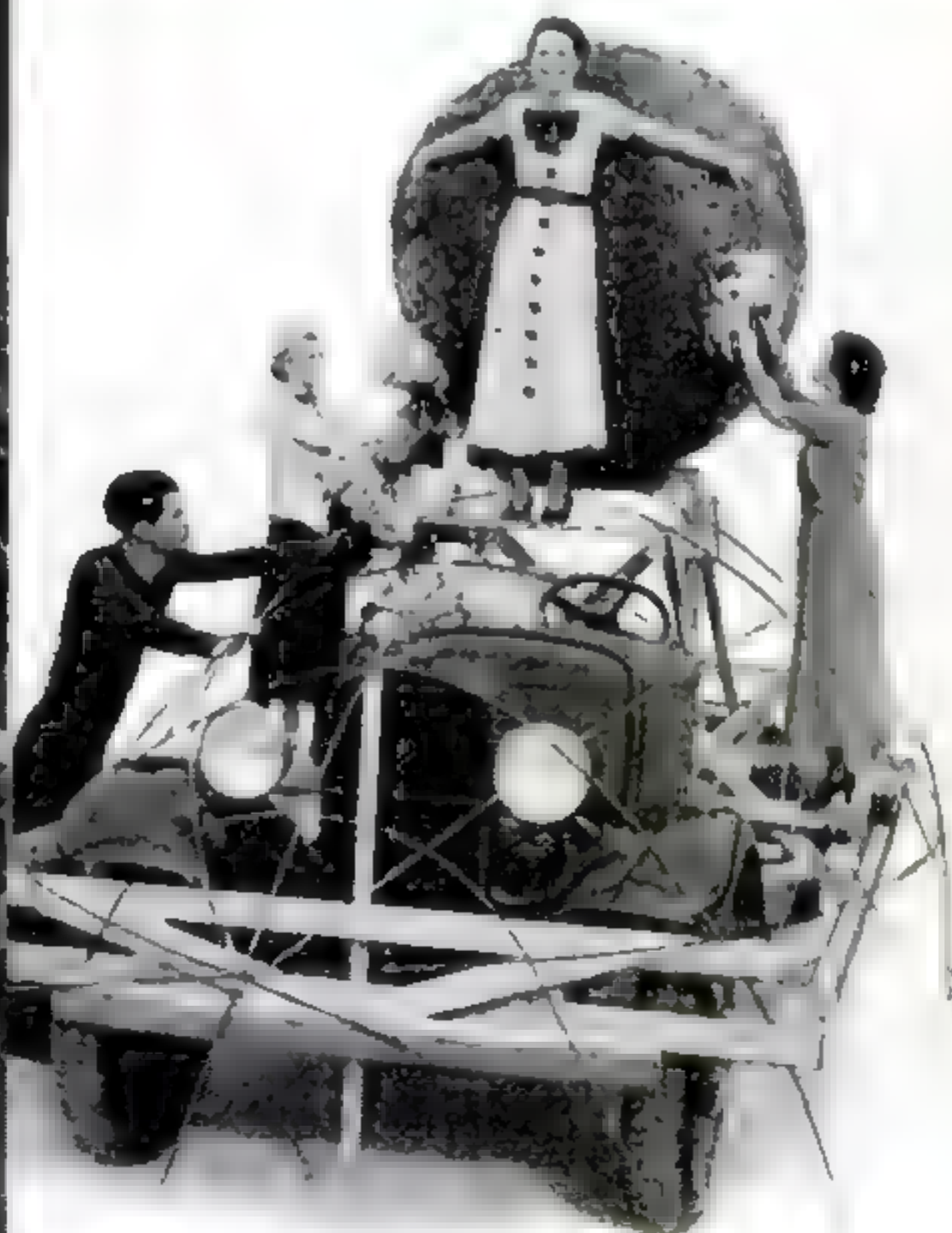
The intricate design below is worked out entirely in blooms. Right, a grotesque figure of papier-mâché, wood, and wire, before covering with flowers



Frameworks of wood and metal rods are erected over truck or pleasure-car bodies, as seen below. In the parade, the trucks usually move backward



Below, putting the flower covering on a float. The globe represents the earth





Drive-In Store Makes Shopping Easier

PATTERNED after automobile motion-picture theaters and eating places, where drivers do not have to leave their cars to see a movie or eat their lunch, a new California

store sells its merchandise to motorists who drive right up to the counters. As shown above, car owners drive in through the store front and leave by an exit at the rear.

With the rotary device cultivating becomes an easier job than hoeing



Hand-Pushed Cultivator Is Aid for Gardeners

LIGHT and easy to operate, a hand-powered rotary cultivator has just been placed on the market for use on farms or in small vegetable gardens. Attached to a wooden handle, an iron roller has long, bent teeth that loosen the earth and break up clods of soil as it is moved along by short push-pull hand strokes.

Convertible Flash Light

HANDY for campers and motorists as well as for emergency use at home is a new flash light which can serve as an electric candle. When the head of the unit is unscrewed and placed lens down on a flat surface, it acts as a support to hold the flash light upright in candle position with the bulb at the top, as shown in the photo at the right.



Chef Carves Statues from Ice

SNATCHING time off from basting roasts, concocting sauces, and whipping up desserts, a chef in the Hotel White, New York City, models figures from blocks of ice. Using a chisel, a knife, and a pronged scraper, the kitchen artisan fashioned the feeding squirrel pictured at the right from a 100-pound chunk of ice in only thirty minutes. His creations are used as centerpieces for banquets and other events.



Figure of a squirrel carved from a 100-pound chunk of ice by Sculptor-Chef Hansen of the Hotel White in New York, seen at work at the left

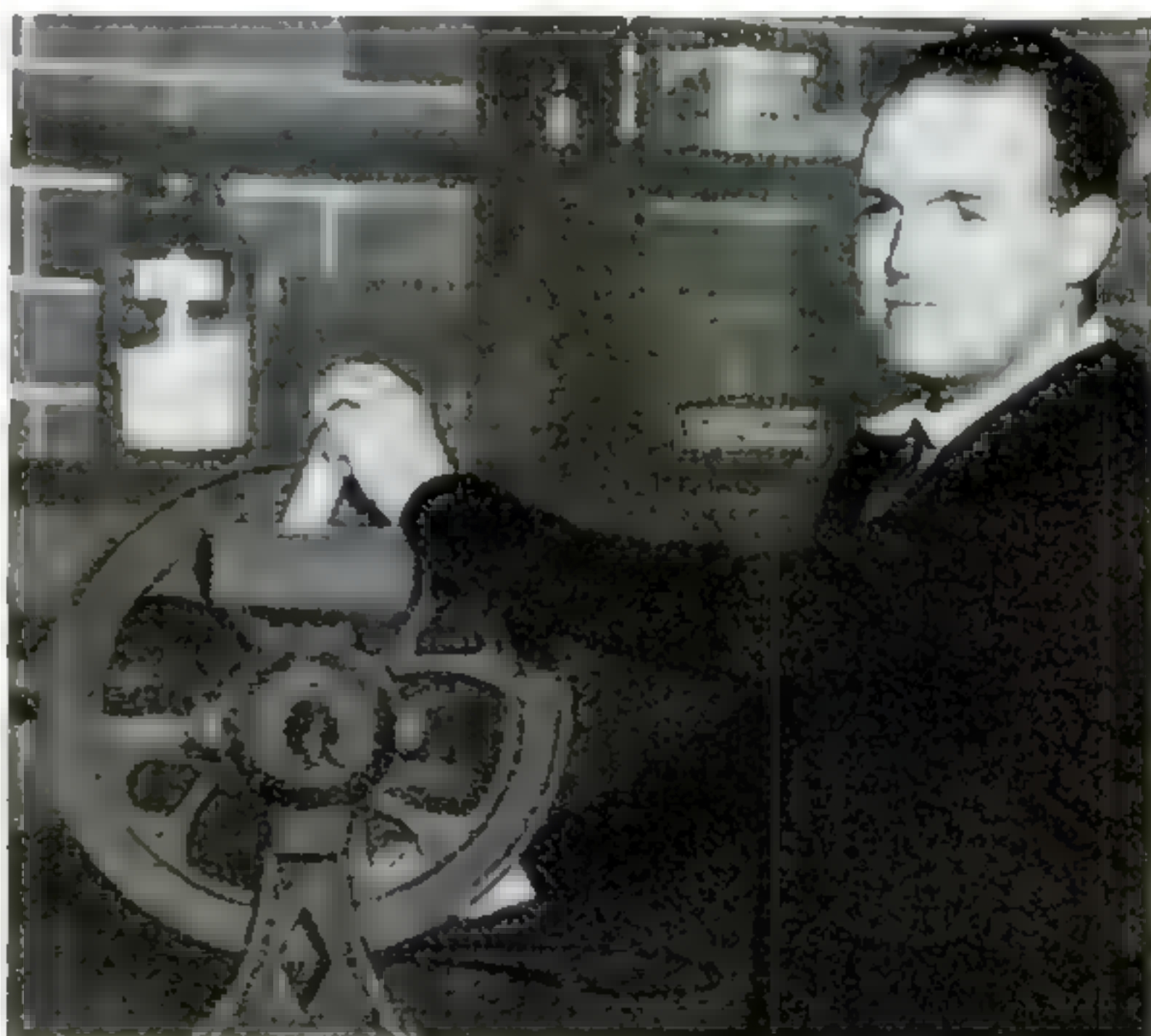


Change Tray Flashes Thanks

WHEN a clerk deposits a customer's change in a novel change tray now available for store use, a sign lights up with a "thank-you" message and a reminder to renew flash-light batteries. Coins contact wires to complete an electric circuit.

"Foolproof" Explosive Gets Novel Test

PULVERIZING a stick of deadly explosive in an old coffee-grinder is the method used by J. W. Dawson, young University of Washington chemist, to demonstrate his claim that he has developed a foolproof substitute for dynamite. Laboratory tests indicate that the new explosive is from twenty to thirty percent more powerful than dynamite, and cheaper to produce. It can be hammered, ground up, bounced on a hard floor, or even set on fire without danger. It is detonated by chemicals.



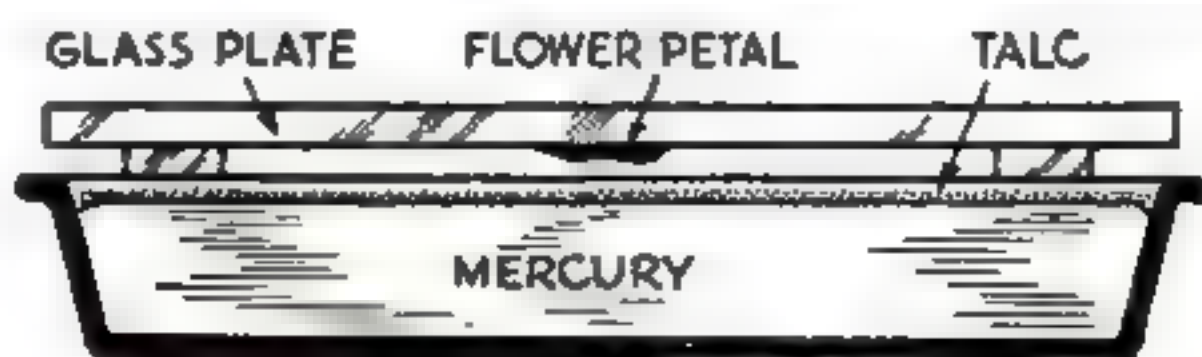
You couldn't do this with a stick of ordinary dynamite

Prof. Henri Devaux of France at work in his laboratory

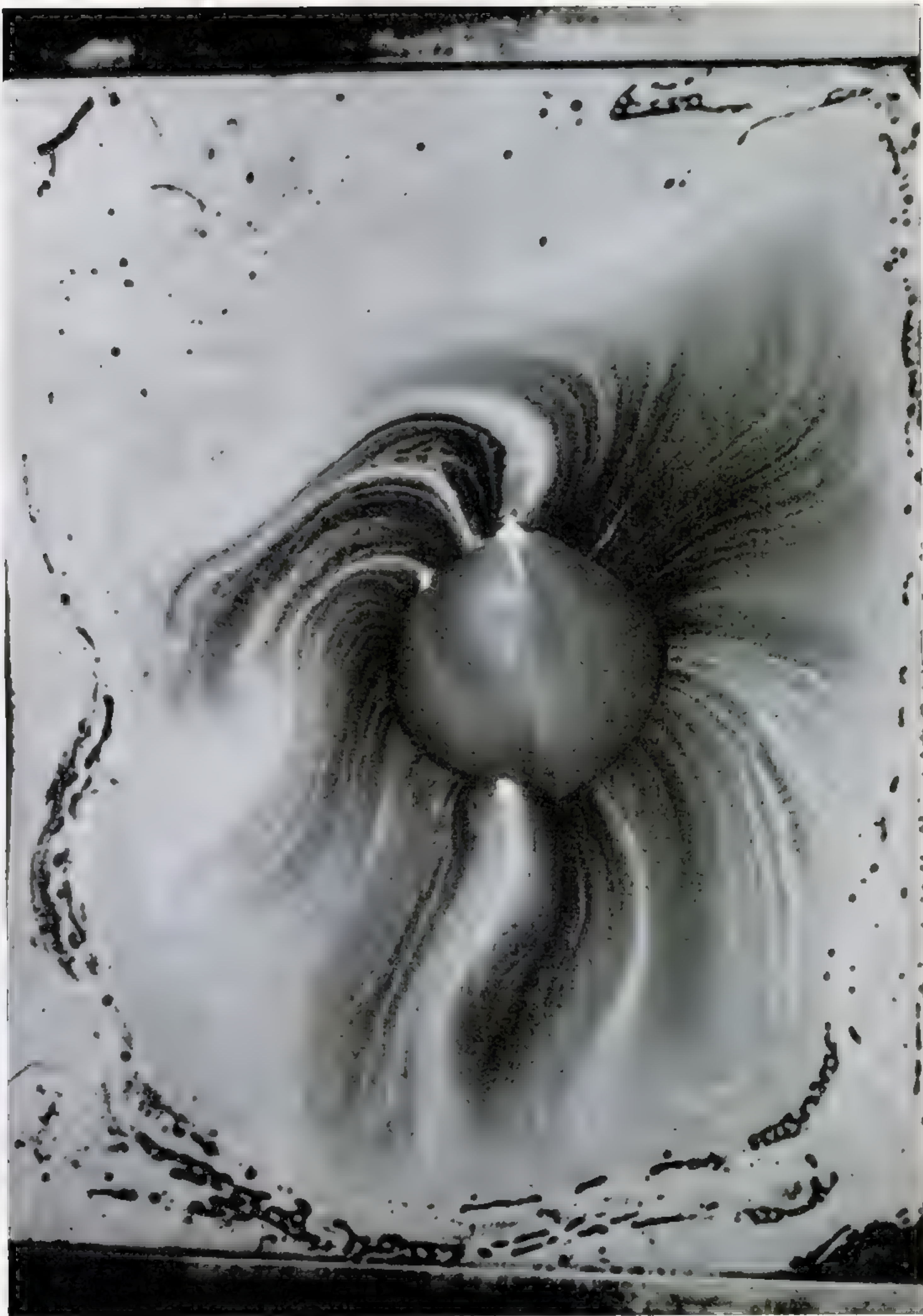


Photographing Smells

FOR the first time, an odor has had its picture taken. By an ingenious technique that makes visible the fragrance of the rose and the lily, a French scientist, Prof. Henri Devaux, has obtained the remarkable photographs reproduced on these pages. His feat proves that smells are tangible substances and not a mysterious sort of radiation, as some experimenters have supposed after failing to isolate them. Spreading them out into layers only one molecule thick, Professor Devaux has succeeded in detecting and measuring quantities too small to tip the most sensitive balance. To do this, he suspends a glass plate, with a flower petal gummed to its under side, a fraction of an inch above talc-coated quicksilver. Perfume emanating from the flower collects on the surface and repels the talc, yielding a growing spot of clear mercury that can be photographed. The strange effect, clearly seen after from one to ten minutes, can be hastened by placing the petal directly in the mercury. Fragrant flowers produce it, while flowers devoid of odor do not, showing that it actually is the perfume that is responsible for the effect.



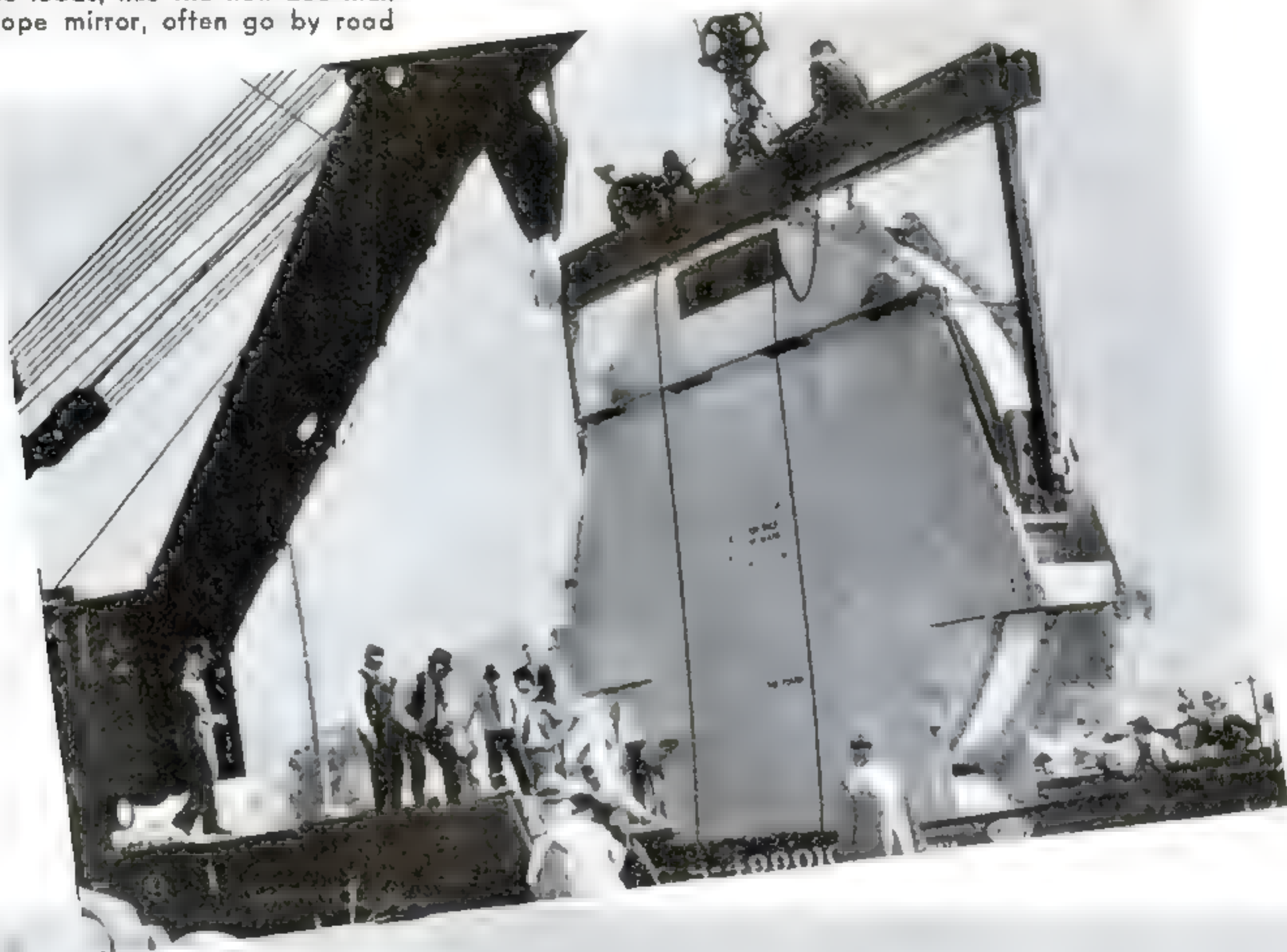
The odor of a lily petal coming in contact with talc-coated mercury, as at the left, formed this weird swirling design



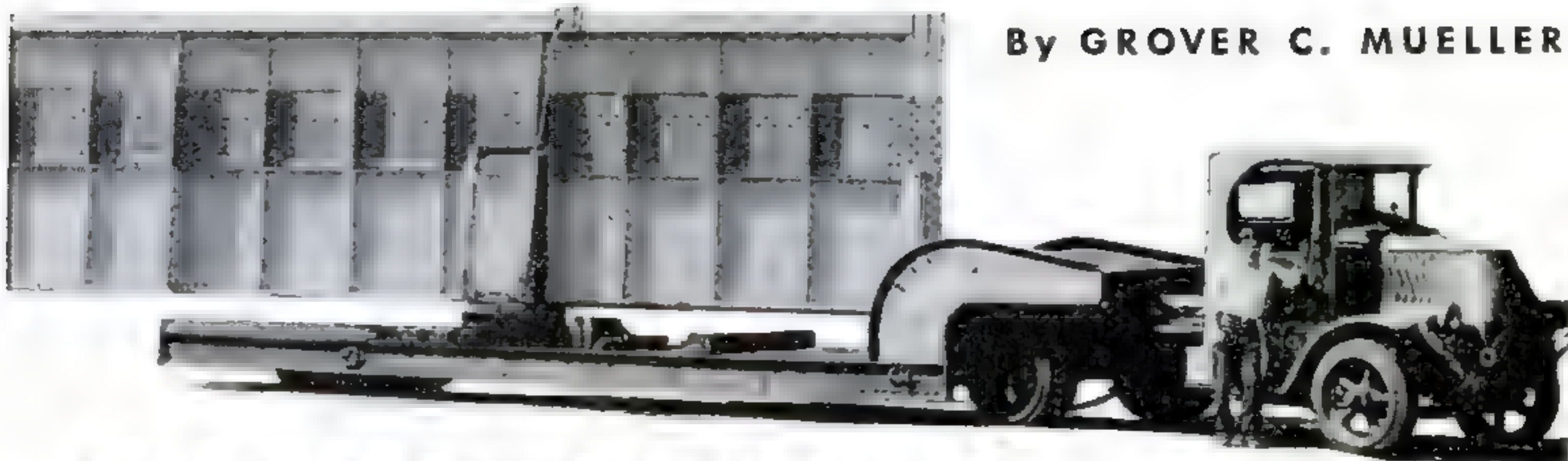
PORTRAIT OF A SMELL. This is how the fragrance of a rose looked to Professor Devaux's camera. The interesting pattern was formed by floating a rose petal on mercury coated with talc



Fragile loads, like the new 200-inch telescope mirror, often go by road



Four freight trains of the highways—trucks and trailers carrying more than a quarter of a mile of pipe



By GROVER C. MUELLER

THEY MOVE ANYTHING

A heavy prefabricated girder loaded for its journey from factory to construction site

IF YOU are driving along a back road and encounter an apparition with thirty-six wheels, four tail lamps, and several dozen additional lights and lanterns, you're not seeing things. It's just the latest and biggest of the freighters of the highways, recently put in service by a Los Angeles truckman. Equipped with a 200-horsepower Diesel motor and twelve air brakes, the huge motor-truck-and-trailer train had plenty of capacity to spare when it recently whisked 100-ton electrical transformers across the city of Los Angeles.

In case you want to move a house, a trolley car, or even a bridge, motor truckmen will do it for you. To carry enormous weights without damaging the pavement, their biggest machines travel on dozens of extra-wide tires. By careful planning, the movers select a route that avoids bridges of insufficient capacity or obstacles. Each different cargo that they tackle raises special problems, solved with ingenuity and engineering skill that make a fascinating show for the passerby who pauses to watch.

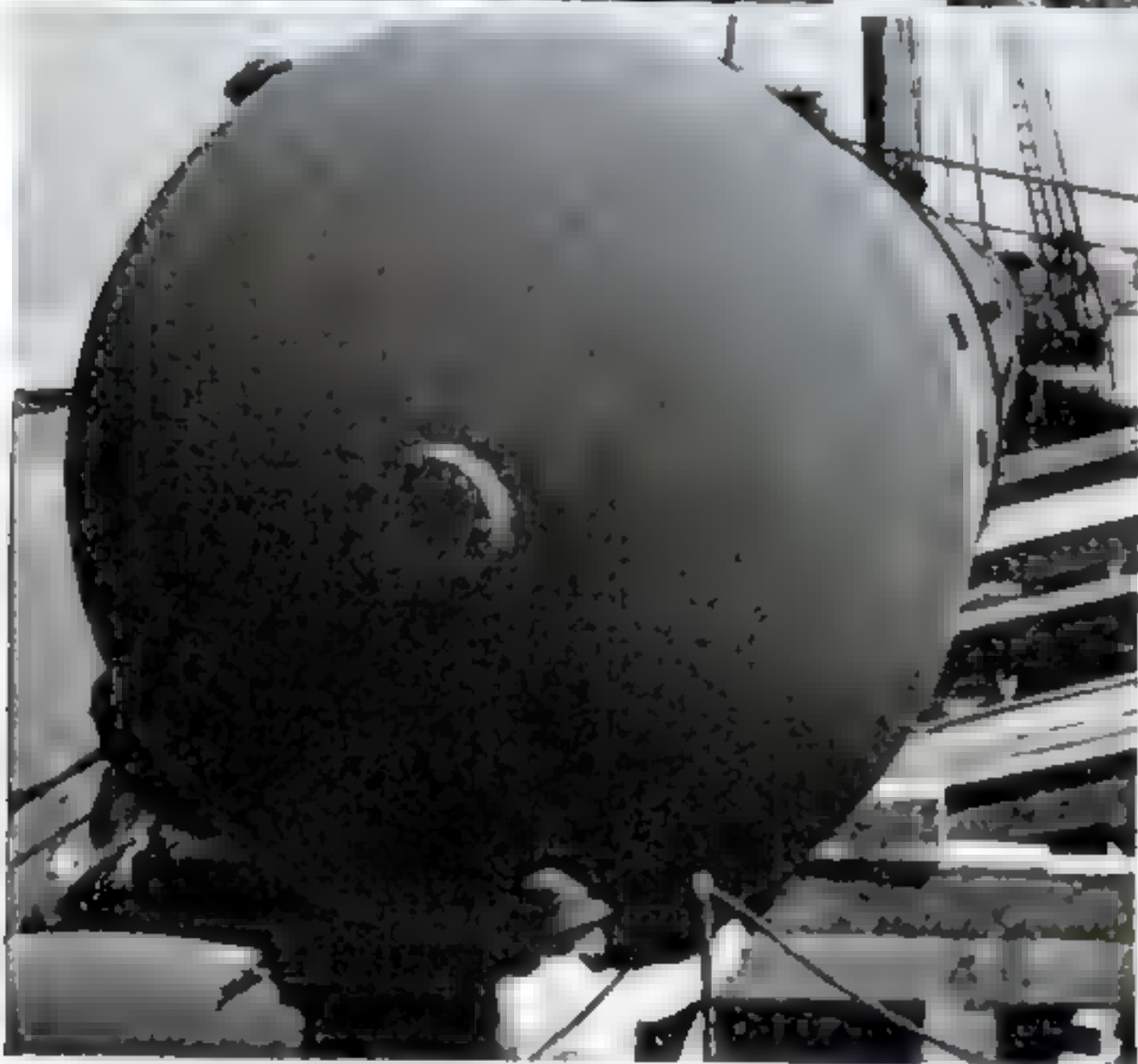
Airplanes may fly across the world, even over the north pole, yet to get a large transport plane from a cow pasture to a near-by seaport recently required more time and power than the flight itself. After three transpolar flyers landed near San Jacinto, Calif., truckmen dismantled the 18,000-pound ship and hauled it to San Francisco. On three

IF YOU HAVE A HOUSE, A PIPE LINE, OR A
BRIDGE TO BE TRANSPORTED, THE WIZARDS OF
MODERN TRUCKING WILL DO THE JOB FOR YOU

occasions they halted while workmen jacked up the unusually wide load to clear bridge rails. The fleet of trucks detoured over seventeen miles of road during the 100-mile journey to avoid narrow bridges, low-hanging branches, and low underpasses.

A short-distance but spectacular moving job took place when a western bank wanted to move its vaults containing \$60,000,000 from one side of the street to the other. A score of policemen, private detectives, and bank guards stood by with tear gas and automatic rifles as a truck crane dropped its line through a hole chiseled in the sidewalk. It picked up the vaults bodily, swung them in a half circle, and deposited them on a stack of soft pads in the cleared street. Then a second truck crane took the vaults from the pads, lifted them across the street-car tracks, and deposited them in the opposite basement. In three and a half hours, the job was done.

Because of the expense saved by fabricating steel at the mills, mighty girders weighing 100 tons or more often travel to their destinations on motor trucks. Pipe large enough for a man to walk through, loaded on trucks and trailers, not long ago wriggled across a



Truckmen were called in to place this 151-ton refinery tank, too heavy for cranes, on a barge

desert like a giant serpent to the site of a new aqueduct. And since they are expert in the art of handling heavy and unwieldy things, motor-truck movers may even be called upon to help load a ship. A 151-ton oil-refinery tower bound for Oleum, Calif., arrived at Long Beach on three railroad flat cars. Given the job of transferring the ninety-three-foot tower to a barge, truckmen took measurements, made calculations, and built a timber skidway from the side of the cars to the deck. Using three gasoline hoists with eight cable drums, they rolled the tower off



Here a trucker's crane is lifting a bank vault containing \$60,000,000 to a new home across the street

When a transpolar plane landed in a pasture, trucks carried it 100 miles overland to a seaport



the cars and lowered it inch by inch down the incline without mishap, successfully maneuvering a weight so great that the barge settled thirty inches into the water as it came aboard.

One of the most ticklish burdens ever carried on a motor truck was the 200-inch, thirty-five-ton disk of glass for the mirror of the world's biggest telescope on Palomar Mountain, California. Padded with mats of sponge rubber, a trailer was backed up to the nearest railroad siding, where the precious disk had arrived from the east on a special flat car. Only after the third try was it loaded so that engineers permitted it to make the four-mile trip to the optical laboratory for grinding. Now truckmen are wrestling with the problem of hauling the mirror up the winding road to the mountain-top observatory, a feat that may already be accomplished by the time you read this.

A thirty-six-wheel freight train of the highways transporting a 100-ton electric transformer. Multiple wheels protect streets from damage



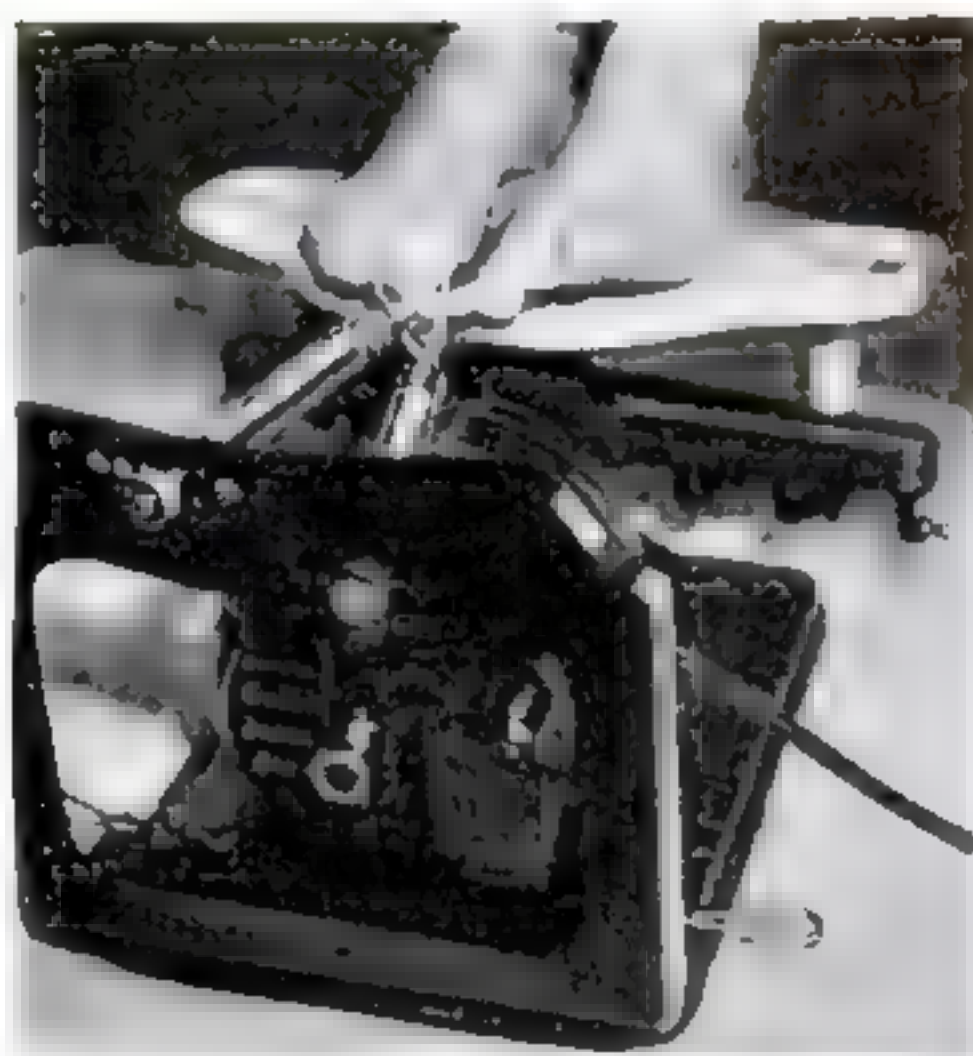


Nursery Chairs Fit into Table

LEGLESS chairs with curved backs fit into circular recesses in a novel children's dining and play table now in use in a Russian nursery. The chairs, which are hinged to the table so that they can be swung out, are designed to insure correct sitting posture, and to keep the children close to the table top, as shown in the photograph above.

Vibrator for Feet Shakes Bunions

BUNIONS and other foot ailments are now being treated with a new electrical vibrating machine demonstrated before a convention of doctors in Detroit, Mich. The apparatus, pictured in use below, is also said to be valuable in strengthening the muscles of the legs.



Giving the toes a vibrator workout



This pelican ash tray "swallows" a burning cigarette as soon as it burns down to the heat-sensitive spring

Pelican Swallows Butts

BURNING cigarette butts are swallowed by the novel pelican ash tray pictured above. If a burning cigarette is laid in the pelican's cavernous bills and forgotten, a heat-sensitive spring raises the jaw to slide the butt safely into the body of the ash tray.

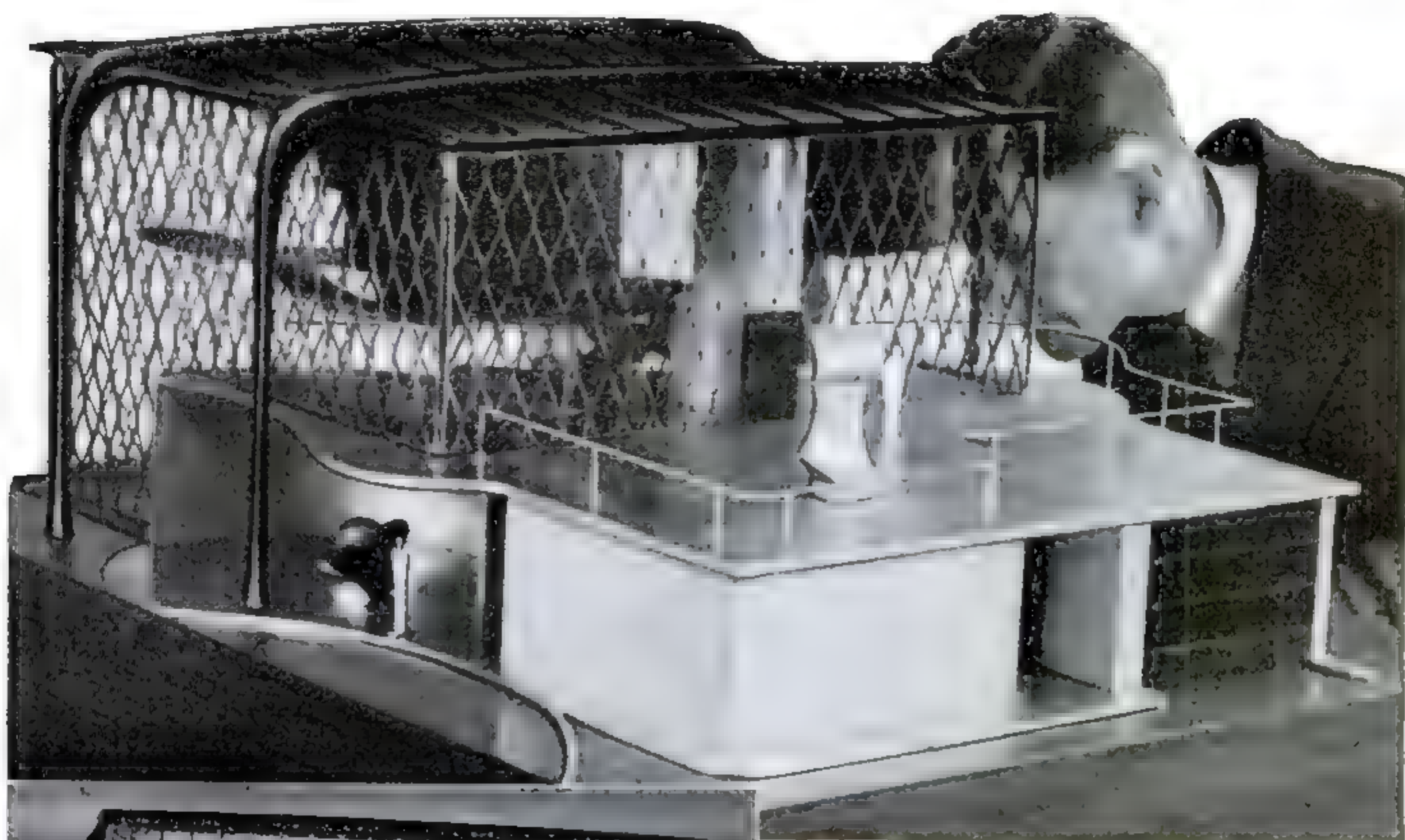
Refrigerator Water Cooler

BUILT into the door of a refrigerator, a reservoir unit invented by H. C. McCartha, of Jacksonville, Fla., insures a plentiful supply of chilled drinking water. Lowering a front panel of the unit exposes a pouring spout for obtaining cold water, as shown below.



A panel in the door conceals a spout for cold water

"House of Future" Hangs On Steel Arches



Upper rooms of the house designed by Paul Nelson are suspended from huge U-shape tubular-steel beams rising from the ground. It has walls of diamond-pattern glass

WHAT private homes may be like in the future is suggested by a unique model designed by Paul Nelson, New York architect. The house is supported by U-shape tubular steel arches, with upper rooms suspended from the ceiling instead of being supported from below. Most of the exterior is covered with diamond-shape panes of glass set at a slight angle to each other to appear opaque from the outside. Kitchen, laundry, and other service rooms are on the ground level, bath and sleeping rooms at the top, and study, living, and recreation areas between the two.

Remote Control Couples Toy Trains

CARS are coupled and uncoupled by remote control with a new attachment now available to owners of model electric trains. With the outfit, a toy-train operator can drop a car on a siding or add cars to a train without touching either. Working by means of built-in electro-magnetic coils, the control will also operate electric dump cars and electric elevators for remote-control loading and unloading.



A push of a button operates the remote-control couplings

Windmill Planes

OPEN NEW FIELD IN AVIATION

WHIRRING gyroplanes, and amazing wingless air machines that soar straight up, hover motionless, and even fly backward, may soon open a new chapter in the history of aviation. That is the prediction of 150 engineers and scientists, gathered a few weeks ago at Philadelphia, Pa., to discuss the remarkable recent advances of rotating-wing aircraft, and the problems that still confront their builders, in the first meeting of its kind ever held.

Proposed helicopter with gas-filled spiral wing. If engine fails, base containing motor and tanks is dropped

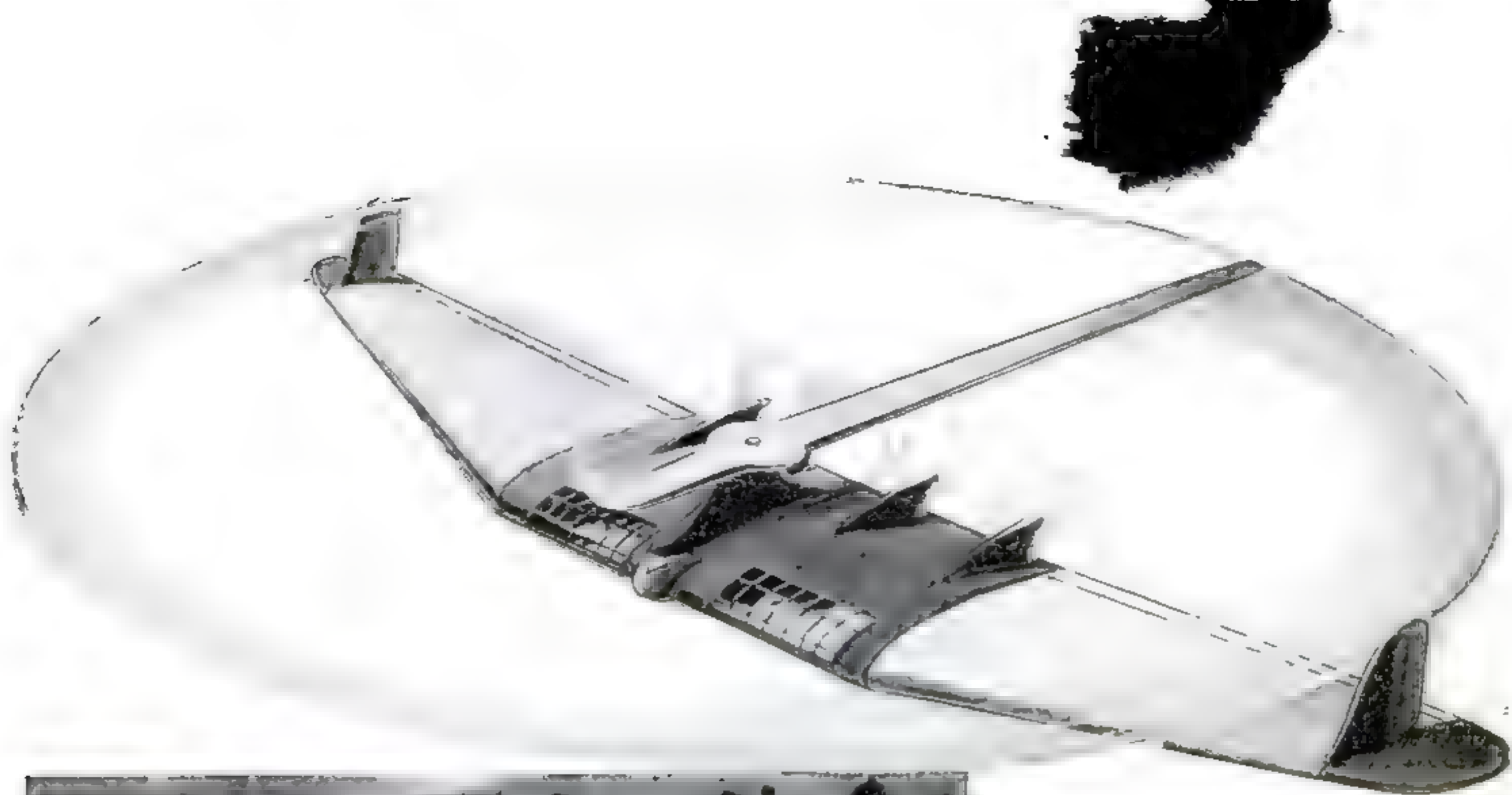


Nor was this mere prophecy. Spurred on by a \$2,000,000 grant from Congress for the study of all types of "whirligig" aircraft, for possible use by the Army, Navy, Coast Guard, Department of Agriculture, and a dozen Government bureaus, active production is soon to boom again.

The first machines to be developed in the big program will probably be gyroplanes, the fantastic "flying windmill" type of craft introduced in this country by the late Juan de la Cierva, in 1929. Holding forth a brilliant future, the autogiro and similar machines were beset with technical shortcomings that had to be solved before they could become a commercial success. After ten years of quiet



Autogiro in flight. It is a cross between helicopter and plane



A transport of 1950, as forecast by an American inventor. It has a rotor wing for take-offs and landings. Left, a girl flyer demonstrating the Focke helicopter in a German hall

Adapted for commercial and private flying, the Focke helicopter will look something like this. Rotating-wing flying machines may supplement regular planes for many uses

experimentation and development, the knottiest problems have been overcome. Strength and efficiency have been increased, and control has been made easier and more certain. Speed has been increased from seventy or eighty miles an hour to 135.

Where greater speed is required, without sacrificing the ability to land slowly and safely on the roughest or most restricted terrain, a convertible plane, designed by Gerard P. Herrick, New York engineer, is the answer. Normally a biplane of conventional appearance, it has the upper wing mounted on a single pivot bearing at its center. This wing may be released and set rotating at will by the pilot, converting the ship instantly from an airplane to a gyroplane.



One of the greatest hopes of the new program, however, is the helicopter, until recently considered a dream almost as wild as that of perpetual motion. Now, it is here. Since the middle of 1937, a machine that can dart straight up, stand motionless in still air, fly sideways and backward, has been flying all over Europe. E. Burke Wilford, of Phila-

delphia, has developed a similar machine, and expects to begin production of helico-gyres—machines that ascend as helicopters and fly or land as gyroplanes—within a few years.

Louis Breguet, famous French aeronautical designer, goes even farther. Before the French Academy of Science he recently presented a design for a helicopter transport that would lift a total load of sixteen tons, fly 310 miles an hour, and excel the efficiency of a conventional airplane!

It is the Focke helicopter, however, that opens the most amazing field of development. Until 1936, many helicopters had managed to get into the air, but once there they lacked control almost completely. Either the torque produced by the spinning rotor whirled the machine around, or a gust of wind overturned the whole thing and crashed it to the ground.

Unlike most previous machines, the Focke helicopter is the result of years of theoretical research, of experiments in wind tunnels and in "flights" while the machine was tied to

the ground. On June 26, 1936, it made its first free flight. A year later it won all existing world's records—rising to an altitude of 8,600 feet, hovering motionless, flying forward at ninety miles an hour, and backward at twenty! So perfect was its control, that in February 1938, a girl flew the machine successfully throughout a Berlin hall, at times hovering only eight feet off the floor while leaning out the cockpit and talking with her associates!

Still another approach to the problem is revealed in the plans of a California inventor for a helicopter having a gas-filled corkscrew wing that whirls on a vertical axis above a globe-shaped fuselage. In this odd ship, rudder and stabilizing surface are mounted on a yoke that pivots on the poles of the spherical gondola to guide the craft in any desired direction. In case of engine failure in flight, the base containing the motor and the fuel tanks can be dropped, allowing the rest of the craft to drift safely down like a parachute.

Somewhat slower, inherently safer, and capable of making landings and take-offs in extremely restricted areas, the rotating-wing machine does not compete with the airplane but supplements it in a field of its own. Among suggested uses are for air taxi or bus service from suburbs to city, military observation, mapping, forestry work, sea rescues, and ship-to-shore service. For private flying, of course, its safety and ease of landing make it ideal.



BOTH BIPLANE AND GYROPLANE

This queer hybrid is a convertible biplane-gyroplane. The upper wing is mounted on a pivot so that it can be released and set rotating at will, thus converting the craft into a gyroplane





Harvesting blossoms for making the costly attar. It takes three acres to fill a one-quart flask



Roses Yield "Liquid Gold" for Perfumes

IMAGINE capturing the fragrance of 3,500,000 roses in a one-quart flask! By performing this fairy-story feat, Bulgarian peasants prepare the world's principal supply of the costly perfume ingredient called attar of roses.

Flower-growing districts like the fifty-mile-long "Valley of Roses," near Karlovo, offer scenes of indescribable beauty at the May harvest season. Solid masses of rose blooms cover beds that stretch away as far as the eye can see. Crisscross paths, just wide enough for two workers to walk abreast, enable the pickers to gather the blossoms in big wicker baskets. In a near-by distillery, workers extract the volatile oil or attar that gives the flowers their scent, using a primitive method unchanged for generations. Over a wood fire, the flowers are heated with gallons of pure spring water in a copper "alembic," or still. Diluted with water from the steam, the fragrant oil is recovered by a condensing coil, and redistilled to concentrate it further. Then it is skimmed from the surface of the remaining water. Worth \$250 a quart, the precious fluid serves as the "raw" material for genuine, or natural, rose-scented perfumes.



Roses by the basketful go into the big stills that extract the fragrance imprisoned in the petals



CONCENTRATED FRAGRANCE

A skilled worker skims the drops of oily attar from the twice-distilled brew. It brings \$250 a quart from perfume makers



It's a knotty problem to solve, but the odd object above, constructed by Henry Bennett, British hobbyist, really is a chair made of tree limbs

Here's a Hobby With Odd Twists

HENRY BENNETT, of Ilmington, near Stratford-on-Avon in England, is known as a man all tangled up in his hobby. Bennett tours the countryside searching for crooked tree limbs, hedge stems, and other tangled wildwood. Back home, he gives a new twist to the furniture business by forming these gnarled pieces of wood into seats and benches. At the left, he is at work on what he insists is a chair.

New Device for Studying Stars

TWENTY times more sensitive than previous devices of its class, a new galvanometer for the 200-inch Mt. Palomar telescope will make it possible to measure the energy of individual parts of a star's radiation. Heretofore, only the total radiation of a star could be measured.

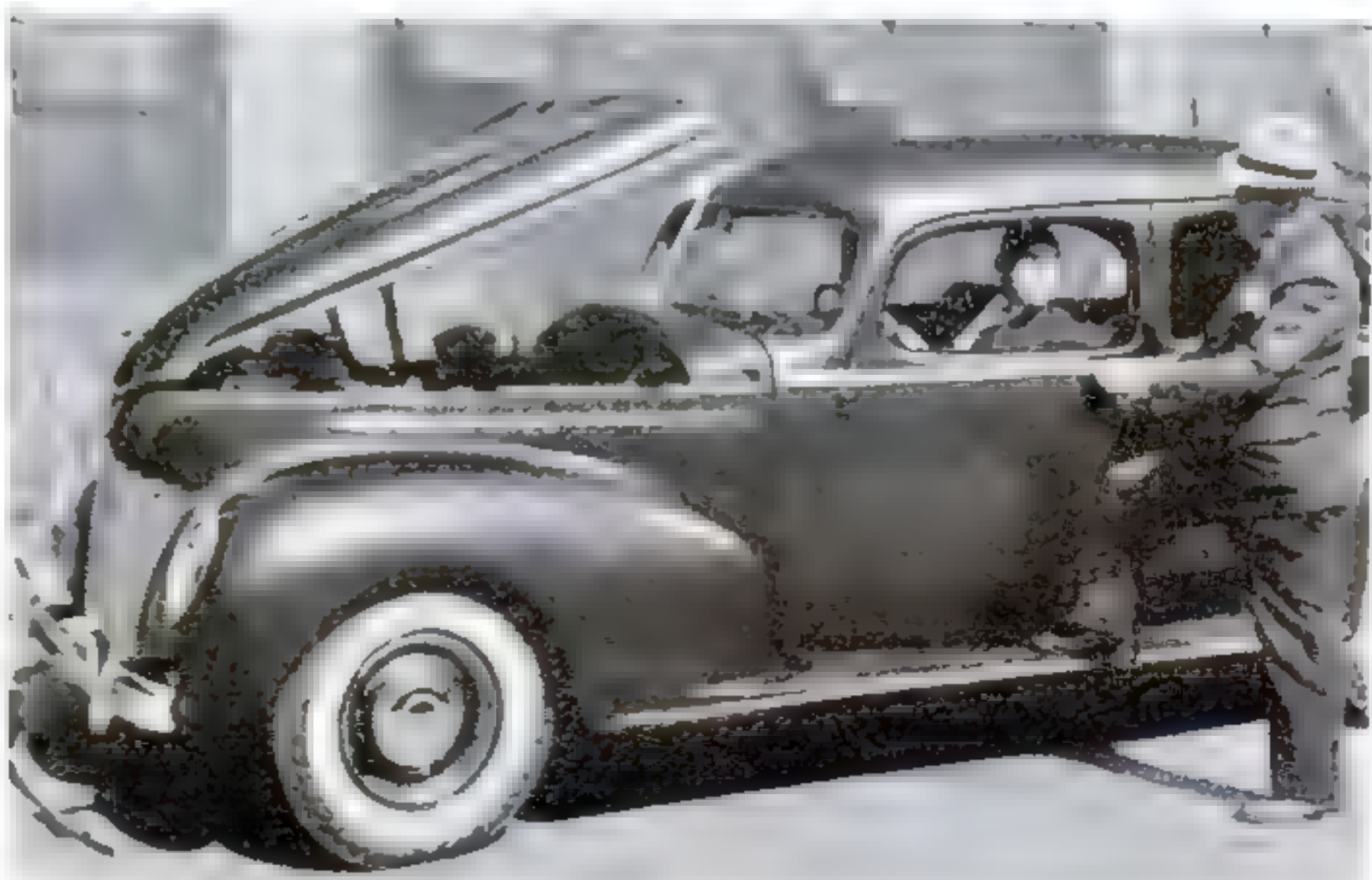
Car's Hood Locked by Hand Lever on Dashboard



Inside the car, this hood lever is out of reach when doors are locked

The driver has operated the latch, permitting the hood to be raised

TO PREVENT petty thieves from stealing detachable engine or battery parts, a 1939-model automobile of a well-known make has its hood fitted with a special locking mechanism. Operated from the dashboard, the unit prevents lifting the hood when car doors are locked.





Kibitzers Get Grandstand

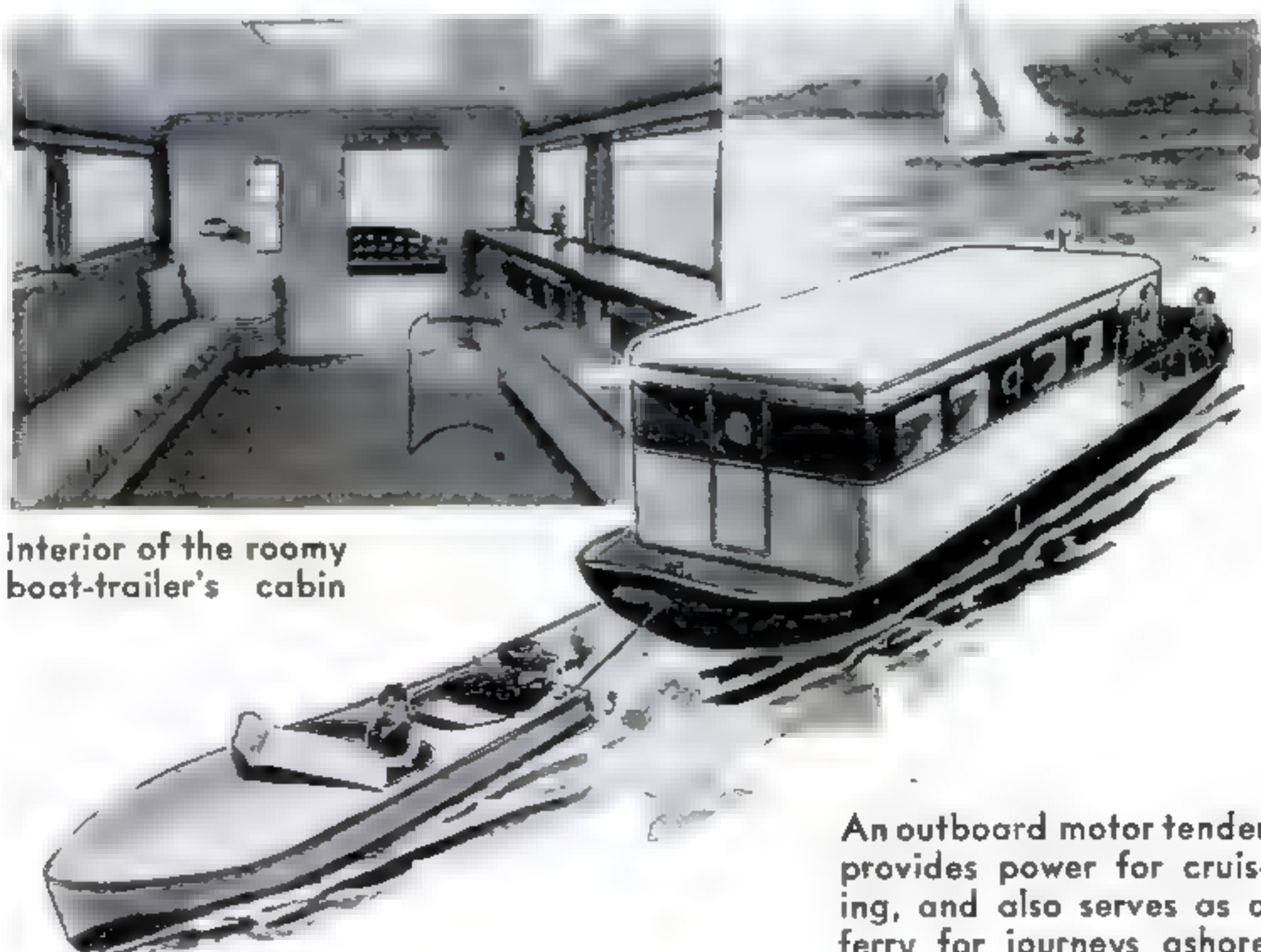
WHILE workers dug, drilled, and blasted a foundation for a new sixteen-story building at Rockefeller Center in New York City, a large sign invited passers-by to join the "Sidewalk Superintendents' Club" and indulge their hobby of excavation-watching in comfort. A 100-foot gallery, erected at a cost of \$750 for their special benefit, provided a safety screen of wire as a protection against flying stones and debris, and a wooden roof for shelter from rain.



Watching excavators dig a foundation from specially made gallery

Marine Trailer for Boat Fans

Now trailers are going to sea, with the introduction of a floating model that can be towed by a small outboard-powered tender. Thirty feet long and eight feet wide, with two cabins and a bathroom, the "marine trailer" provides homelike comforts for week-end trips or extended cruises. Its appointments include an electric-light plant, ice box, stove, shower bath, hot and cold water, and a large fresh-water tank.



Interior of the roomy boat-trailer's cabin

An outboard motor tender provides power for cruising, and also serves as a ferry for journeys ashore

Making Pipes for Fun



1 This is the raw material—rough blocks of Algerian brier costing about twenty cents each. Mixed with them are some partly finished pipe bowls

2 At right, a block has been roughly marked with pencil. Best wood is nicely figured and free from holes, and has grain running "with the smoke"

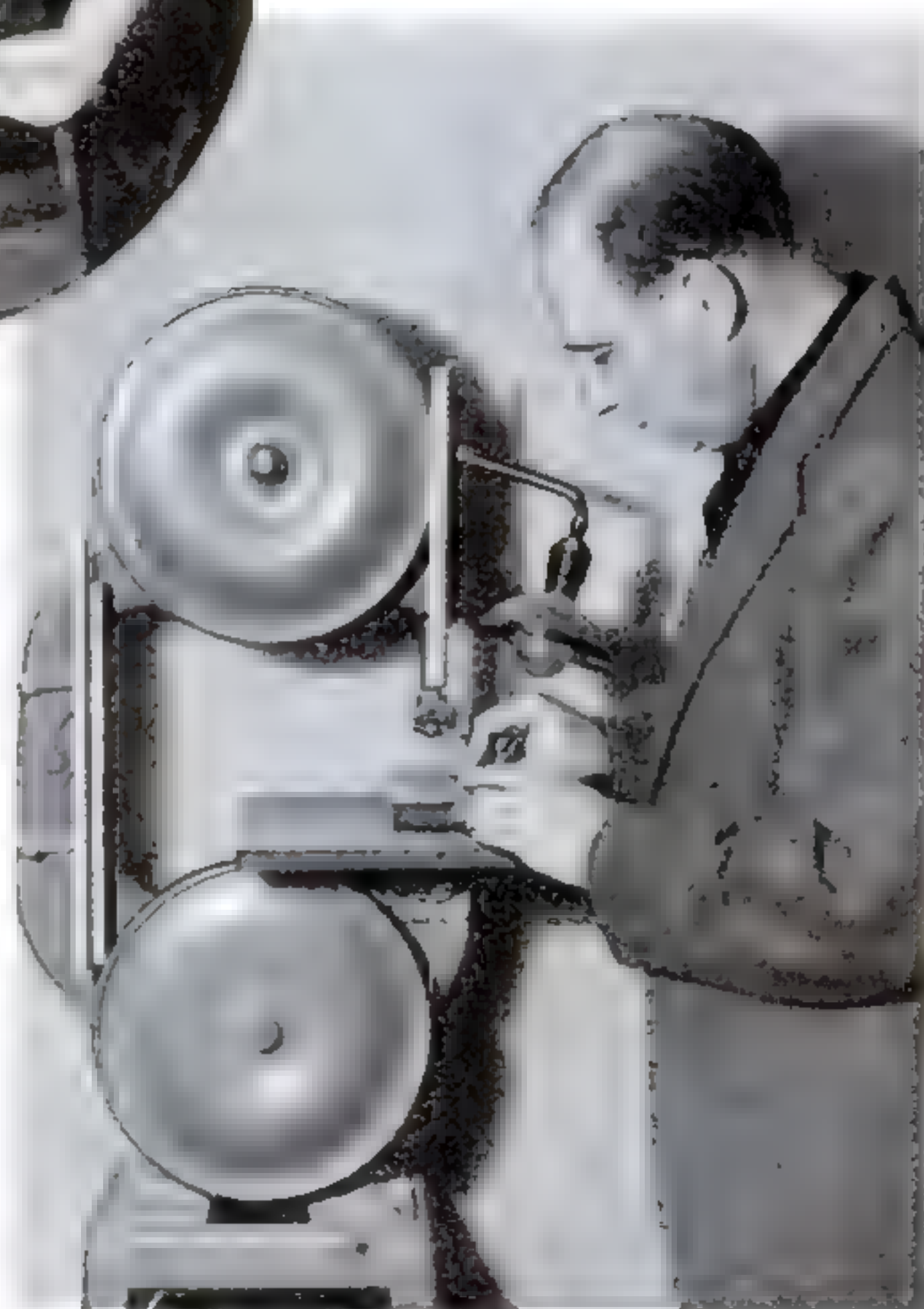


4 Close-up view of the band-saw operation. Note how the bowl and shank portions are blocked out

Stanley W. Kempner Shows You How He Turns a Block of Brier into a Beautiful "Custom-Made" Pipe That the Most Fastidious Smoker Would Be Proud To Own

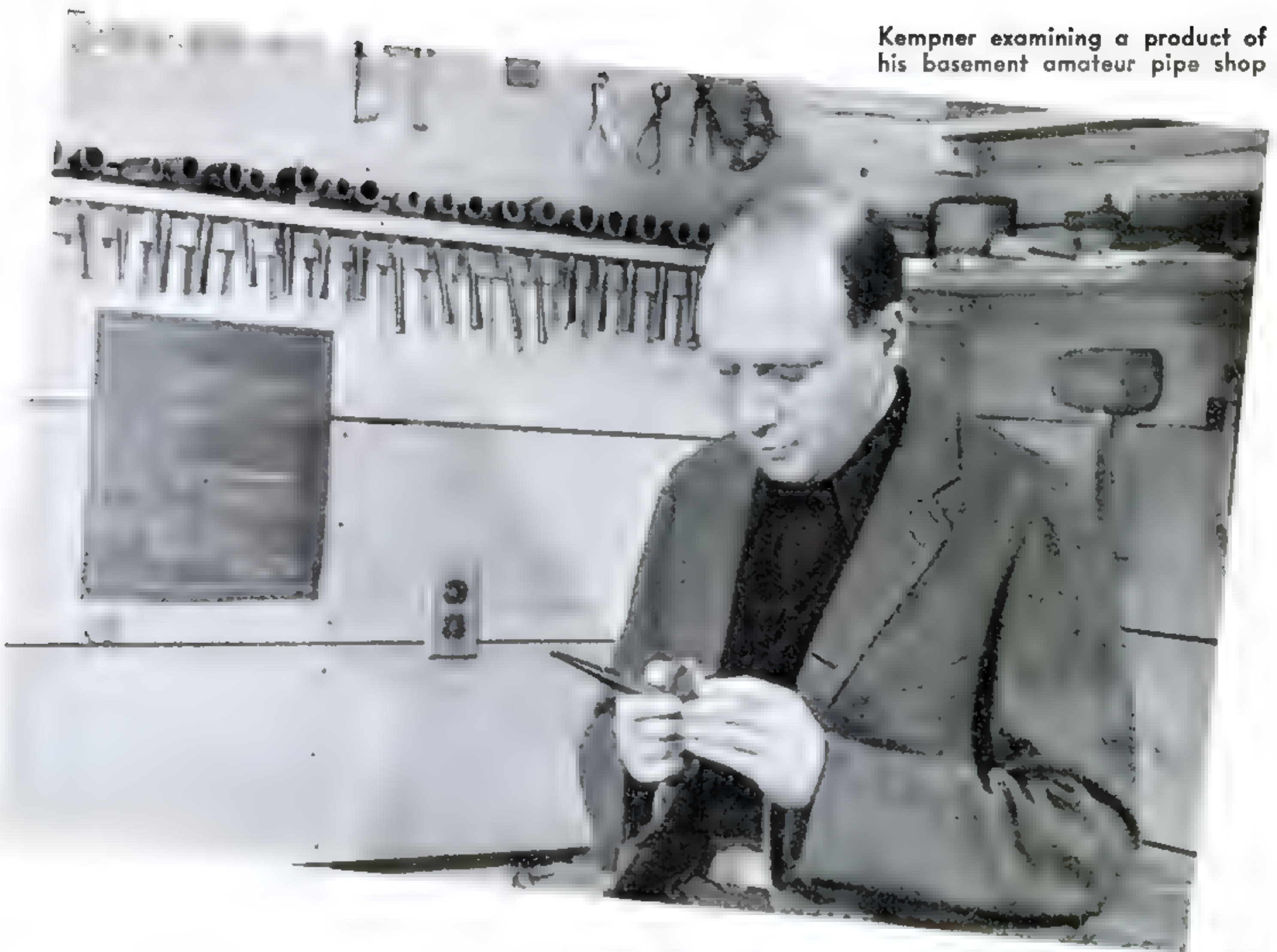


By
**KENNETH M.
SWEZEY**



3 Following the penciled lines, which indicate the rough outlines of the pipe design that he is creating, Kempner shapes the block on a band saw. He has \$200 worth of special equipment

Kempner examining a product of his basement amateur pipe shop



WHEN Stanley W. Kempner wants to smoke a pipe, he can take his pick from some 150 of his own private brand. With about \$200 worth of special equipment in his cellar workshop, and four years of study and practice in the technique of the craft, this New York City real-estate man probably ranks as America's No. 1 amateur pipe maker.

There is nothing amateurish, though, about Kempner's methods. When he decided to try his hand at pipe making, he went at it in the right way. A course in woodworking was followed by a study of the technique of expert craftsmen. At first, it took him days or weeks of spare-time work to make a pipe; now he can turn out a workmanlike job in little more than an hour!

Although Kempner has a collection of grotesquely shaped and weirdly ornamented pipes from other lands, his own pipes invariably follow simple lines. Often he makes pipes to suit the peculiar whims of individual friends. Once a fastidious architect sent him a detailed blueprint, which he worked out in brier and vulcanite.

Proud of his amateur standing, Kempner will never sell a pipe for any price. They are handed out only as distinctive and unique tokens of friendship.

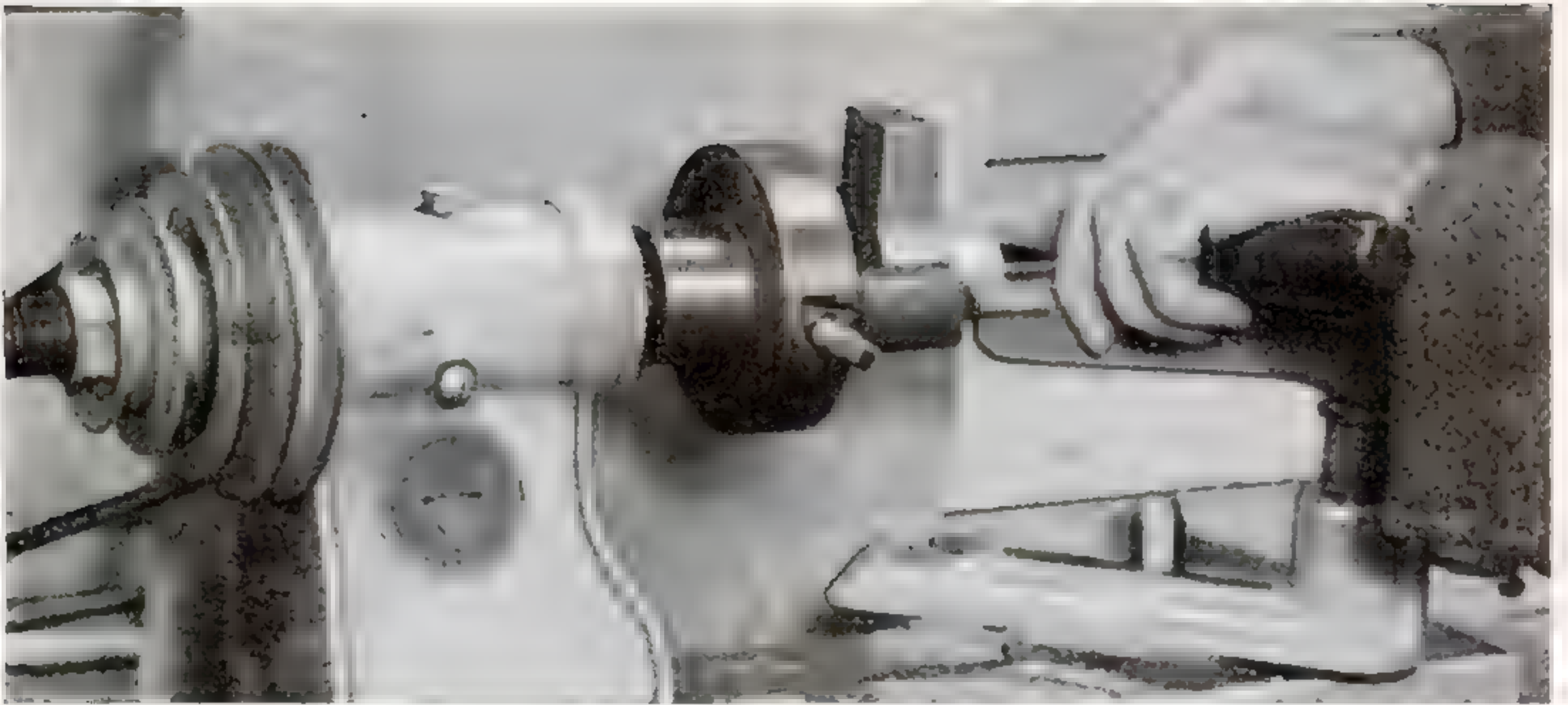
Kempner's chief machine in pipe making is



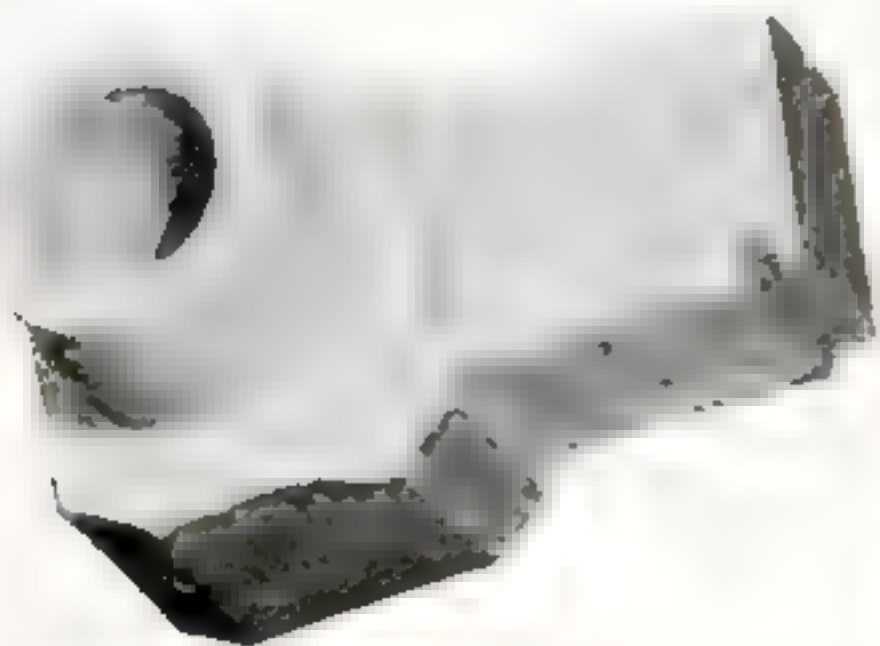
5 The work is now locked in a special lathe chuck in preparation for turning the bowl



6 As the chuck turns, the chisel is directed by skilled hands to shape the outside of the bowl



7 To shape the inside of the bowl, Kempner steadies a boring tool with a chisel held in his left hand



8 With bowl turned and bored, the pipe now looks like this



9 It goes back into the lathe for the turning of the slender shank



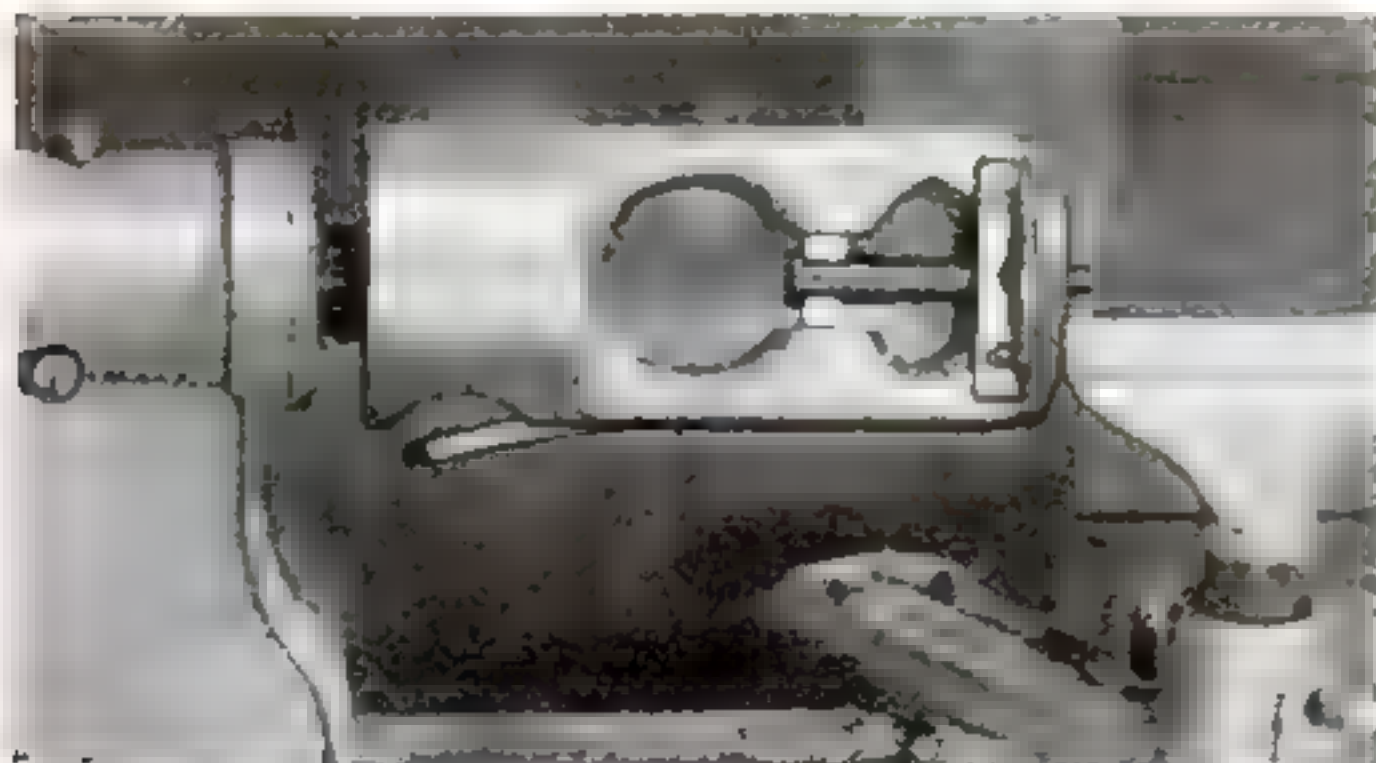
10 The shank is turned. It is then drilled and bored



11 The band saw comes into action again to remove the excess wood left between turnings



12 Remaining excess wood is routed with a toothed milling wheel to shape bottom of bowl



13 A molded vulcanite bit, bought ready-made, is locked in a special pipe-maker's lathe chuck

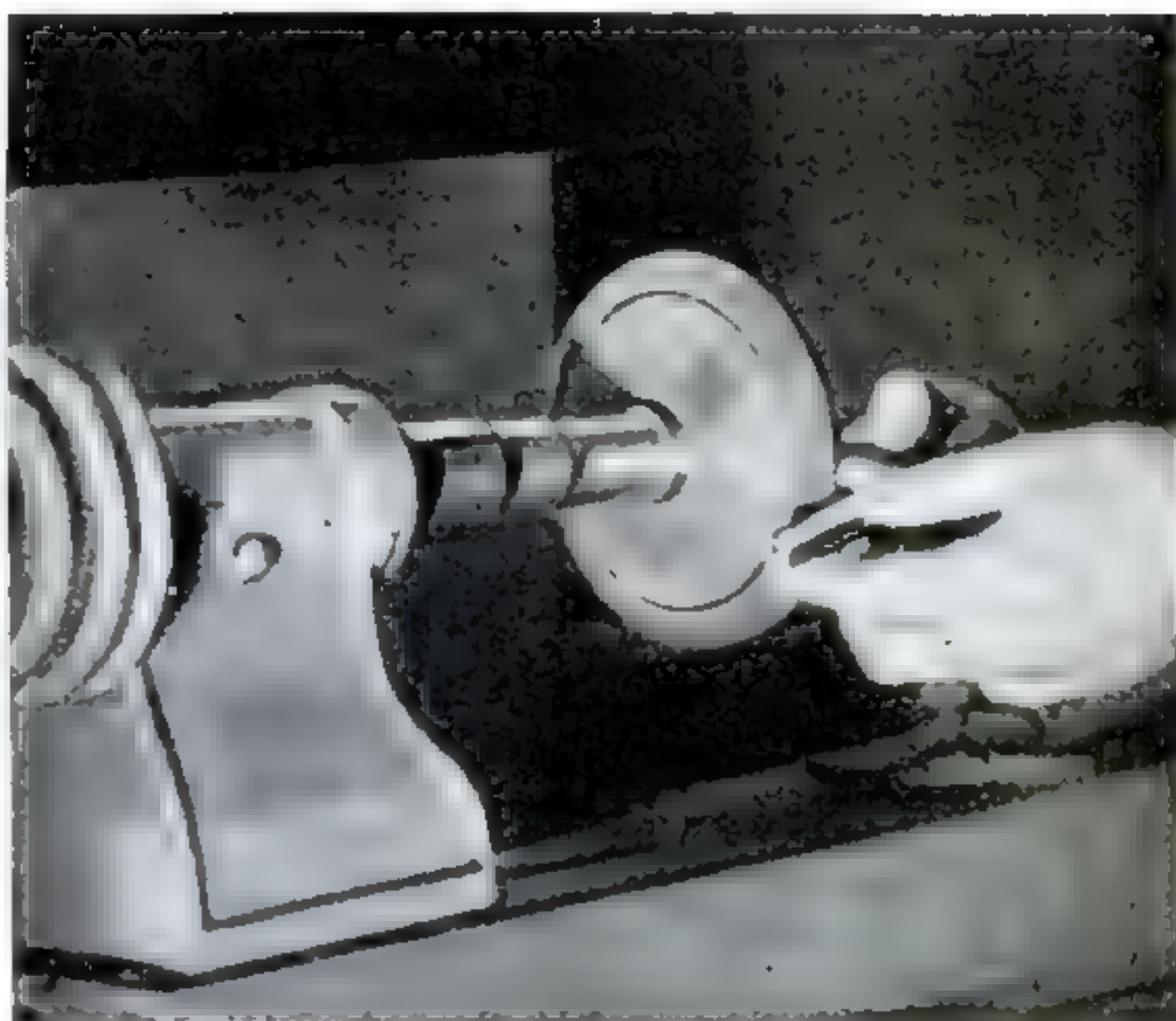


14 Centered accurately by the special chuck, the end of the bit is turned to fit the pipe shank

a motor-driven lathe fitted with special chucks and milling, abrasive, and buffing wheels. His tools are simple chisels and flat drills, which are guided only by keen sight and an expert hand.

In coloring a pipe he avoids heavy stains and lacquers that clog the pores of the wood

and hide the natural beauty of the grain. Sometimes he employs a standard aniline dye. More often, however, he uses ordinary tincture of iodine, or even mercurochrome! These commonplace materials give a beautiful brownish or reddish finish that allows the wood to "breathe."



15 A sanding wheel removes any irregularities

16 Final smoothing is done with an emery wheel, and then with a buffer bearing tripoli powder



18 Last of all comes the final polishing on a buffer covered with a soft cloth

17 Kempner now applies a stain that shows up the grain and permits the wood to "breathe" through its pores



19 And here is the finished pipe, ready for smoking. The whole process shown in these pictures took about an hour

Strain Gauge Tests Props in Flight

ONE of the difficulties in designing airplane propellers has been the inability of aircraft engineers to determine accurately the stresses caused by vibration as the propeller whirls around. A new technique, just announced by United Aircraft engineers, is said to permit accurate measurement of the stress at any point along a propeller blade during test operations on the ground or in actual flight. Based on the fact that certain materials change their electrical resistance in direct proportion to the stress imposed upon them, the new system employs two-inch carbon strips which are cemented to, but insulated from, the section of the propeller blade being tested. Wires from the strips lead through a collector ring, or commutator, on the hub to recording apparatus. Here an oscillograph converts the resistance changes, caused by vibration stresses transmitted to the carbon



Mounted behind the propeller, a commutator contacts brushes to provide connections between the carbon strips and the recording device

strips, into light waves, which are permanently recorded by focusing them on a moving strip of light-sensitive paper. Ground tests are made with the recording apparatus housed in a soundproof, vibrationproof building a quarter of a mile away from the plane. When the apparatus is carried aloft for tests, it is used primarily to record the time and location of the varying stresses imposed on the propeller by engine or plane vibrations, often leading to discovery of faults affecting the propeller, but not in the propeller itself.



How the carbon strip is cemented to a prop. Strain in the blade also strains the carbon, varying the current

An oscillograph in the cabin changes the fluctuating current into a moving finger of light that traces a telltale wavy line on sensitized paper



Child's Music Book Contains Xylophone

ANY child who can recognize numerals from one to eight can play tunes on a miniature xylophone built into an illustrated song book which contains the words and simple melodies of about a dozen popular nursery tunes. A number under each note shows the child which of the xylophone bars to strike. The xylophone is mounted on the inside back cover of the sturdy book, and is played through an opening formed by windows cut out of the pages.



Numbers show which bars to strike for various notes of a tune

Comb Holds Nail File

POCKET comb and nail file are combined in one unit now on the market. The file, approximately four inches long, is hinged at one end to the comb, and concealed in a slot along the comb back when not in use.



Electric Hand Warmer

DESIGNED especially for use at subzero temperatures, an electric hand warmer now available is operated by dry cells. A metal cylinder containing a heating element is wired to a battery housed in a leather case hung from a strap over the shoulder.



The hand warmer in use. The case holds the battery



New Fire-Escape Harness Slides Wearer to Safety

TWO ropes, a leather harness, and an iron yoke are the main elements in a new emergency fire-escape system. As pictured above, a person is strapped to the yoke, which slides downward along two flexible cables. Firemen on the ground hold the ropes taut and spread them apart to keep the speed of descent under perfect control.

Music and colored lights are directed down into the majestic gorge from this lofty, rock-ledge control



Drawings by
B. G. SEIELSTAD

Natural Bridge Wired for Lights and Music

MAN-MADE light and sound are combined to enhance the beauty of one of America's great scenic marvels, the natural stone bridge that spans the gorge of Cedar Creek in the Shenandoah Valley of Virginia. Nighttime spectators, seated at the bottom of the gorge, 215 feet below the mighty arch of stone that supports one of the state's main highways, watch hidden lamps play a pattern of light and shadow on the gray canyon walls, as the soft strains of orchestra and organ music seem to pour downward from the darkness of the sky.

How this impressive pageant of sound and color is produced is shown in the illustration above and at the right. In a central control room overlooking the gorge, an operator manipulates a battery of switches and dimmers that regulate a string of forty-seven red, white, and amber spotlights, which line both rims of the cut. Near this switchboard, twin motor-driven turntables whirl alternately to play a continuous special musical program.

This recorded program is amplified and broadcast by three loudspeakers, the largest of which is so placed that the sound is reflected down into the canyon by a domed area in the canyon wall that serves as a natural sounding board.

Historic as well as scenic, the natural bridge of Virginia was first privately owned by Thomas Jefferson. About 1750, it was surveyed by a young civil engineer named George Washington. And in the Revolutionary War, it served as a shot tower. Molten lead was dropped from the bridge into the stream below, gravity making the leaden drops spherical, and the sudden plunge into cold water "freezing" them into bullets for the American Army.



MAIN HIGHWAY THROUGH SHENANDOAH VALLEY OF VIRGINIA

CONTROL CENTER FOR
SOUND AND
LIGHTING EFFECTS

DOMES OF NATURAL
BRIDGE ACTS AS
SOUNDING BOARD

AUDIENCE

Even at night, tourists can now view the splendors of the natural stone bridge in Virginia's Shenandoah Valley. A dome of rock serves to reflect the recorded music down into the 215-foot-deep gorge.



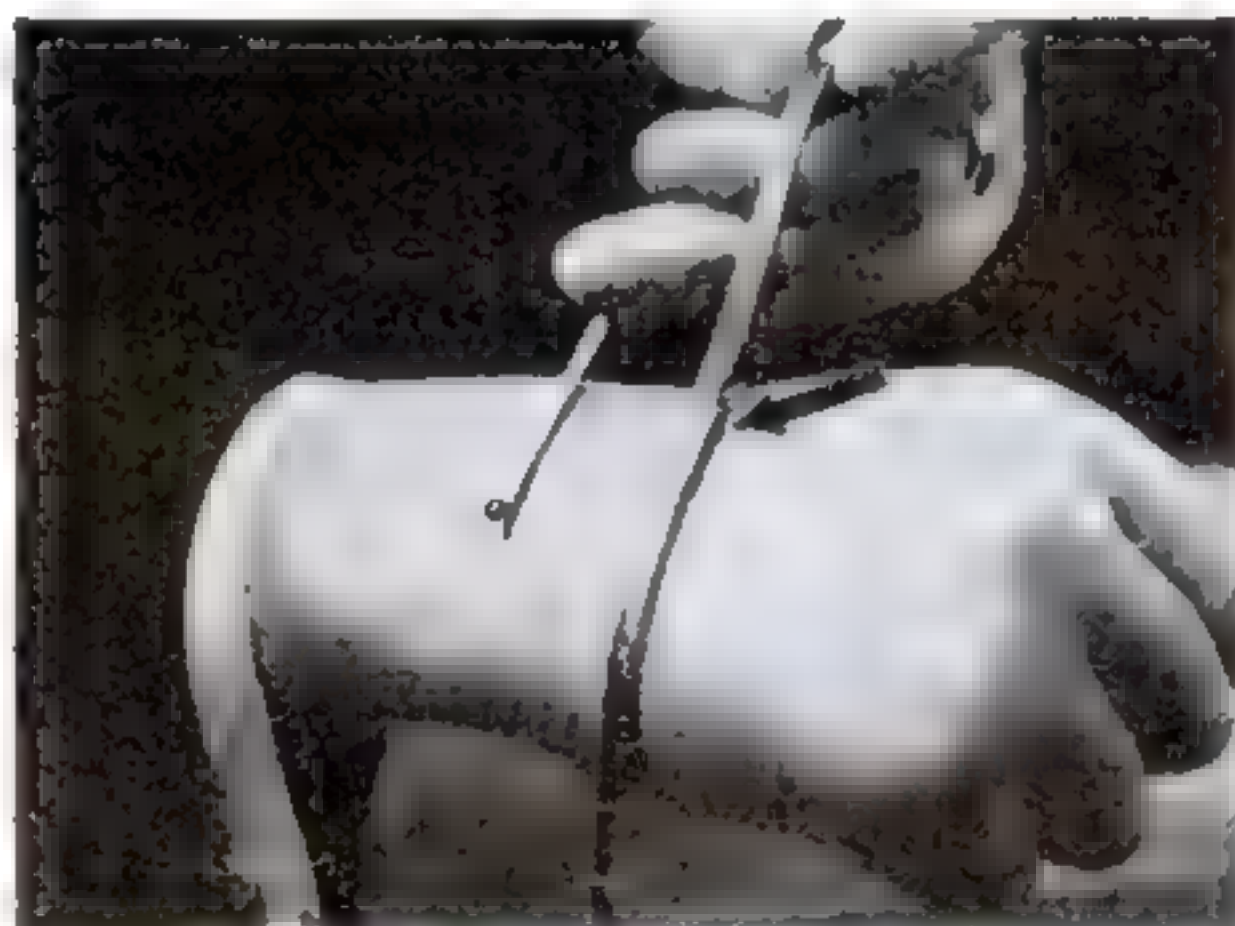
Portable X-ray machine set up for use. It weighs only thirty-five pounds

X-Ray Machine Can Be Carried to the Patient

AN OUTSTANDING feature of a new X-ray machine recently demonstrated before a convention of osteopathic physicians and surgeons in Detroit, Mich., is the fact that it is portable, and can be easily transported from one location to another. Designed to operate on standard house current available in most homes, the apparatus can be taken to the sick-room of a patient when it is not possible for him to come to the office of a physician. Said to be the smallest of its kind, the machine weighs only thirty-five pounds.

Match Dwarfs Wrist Watch

ABOUT the width of a conventional shoe lace, a tiny timepiece exhibited at an exposition in Stockholm, Sweden, is said to be the smallest wrist watch in the world. Of Swiss construction, the Lilliputian watch contains more than seventy parts, although it is just over one half an inch long and less than one fifth of an inch wide. It is shown at the right compared with a wooden safety match.



Midget wrist watch compared with a match

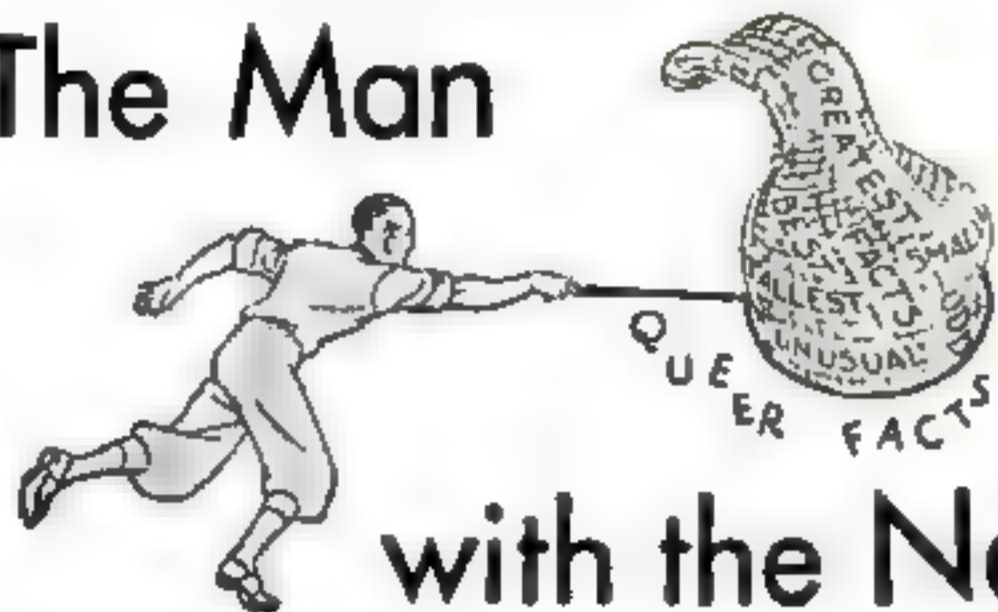


Wylie Harris in his odd boat. Pipes at bow and stern are ventilators

Tublike Boat's Cabin Is Water-Tight

IN THE odd boat pictured at the left, Wylie Harris of Chicago, Ill., its designer and builder, plans to travel from Chicago across Lake Michigan to Benton Harbor, Mich., a distance of approximately sixty miles. The short, stubby craft is made of sheet steel, with a cabin that can be closed and made immune to breast-high waves in stormy weather. When the hinged cabin roof is closed, ventilating pipes circulate fresh air through the interior.

The Man



with the Net

BETWEEN the end of the Civil War and 1930, the number of microscopes in America increased from about fifty to 50,000.

HONEYCOMB CELLS are circular in interior cross-section, not hexagonal.

GENERAL SHERMAN, the largest tree at Sequoia National Park, Calif., is estimated to weigh more than 1,700 tons.

WOODPECKERS use their stiff tails as props when clinging to the side of a tree.



MORE THAN 100,000 ships have passed through the Panama Canal.

OLDEST CHILDREN in large families usually live longest.

ONE MILLION dollars in twenty-dollar gold pieces would weigh one and seven eighths tons.



VISALIA, CALIF., is said to have the smallest public park in America. It is nine feet long and six feet wide.

SEA BIRDS get seasick when they are confined in cages on shipboard.

CROCHETED miniature houses are made by a woman in Brooklyn, N. Y.

SOUTH AMERICAN orioles sometimes build a nest six feet long.

EGYPTIANS used raw meat as a remedy for black eyes.



New Table-Top Golf Game Calls for Playing Skill

TABLE-TOP golf is a new game for children just placed on the market. A mottled-green, recessed playing board, made of a synthetic resin, has eighteen circular holes representing those on a real golf course. To the center of the board is attached a springy metal wire that runs through the center of a miniature golf ball. The object of the game is to adjust the position of the ball on the wire, and then spring it so that it rolls into a specified hole.

Adjustable Cheese Cutter "Weights" As It Slices

CHEESE in loaf form is easily sliced with a novel cutter invented by William K. Coleson, of Brooklyn, N. Y. Designed primarily for restaurants and stores, the unit slices cheese between a cutting wire, supported by a Y-shape frame, and a roller, which is adjusted by means of a calibrated scale to cut slices of any approximate weight up to twelve ounces.



A knob on the handle adjusts the slice's thickness

Handy Aids

Vertical Viewer for Film

BY COMBINING a mirror and a magnifying glass, a western manufacturer has produced an inexpensive viewer for examining home-movie film. Pictures on the strip, passing through the viewer in a horizontal position, appear right side up as on a movie screen.



Images on the film strip appear in vertical position

Brace Steadies Camera

TELESCOPING into position, a new brace is said to permit hand-held time exposures with a miniature camera. A ball-and-socket joint joins the camera to the brace, while a rubber tip pressed against the body holds it steady during use.



The flexible frame is bent to conform to the shape of the 100-watt lamp bulb

Left, how sensitized paper is placed over a film in the frame

New Photo-Printing Paper Requires No Darkroom

ORANGE dye in a newly developed sensitized paper is said to provide a "built-in" safelight so a darkroom is unnecessary in making photographic prints with the material. According to the manufacturer, the paper can be handled in a room lighted with electric lamps, or even in daylight, without fogging the print. The new product is sold in kits containing paper, developer, hypo, and a special flexible frame. In use, a sheet of the "safelight" paper is slipped into the frame beneath the negative and the frame is bent between thumb and fingers to conform to the shape of an electric bulb, so all parts of the paper will receive the same amount of illumination. When the developed picture is placed in the hypo fixing bath, the orange dye dissolves. The prints are said to be clear and permanent.

Spoon Weighs Chemicals

A SLIDING weight in the handle of a newly marketed spoon enables it to be used as a scales for weighing photographic chemicals. The weight can be set for any amount up to ten grams. Held by a chain, the spoon is filled until it is brought into balance.

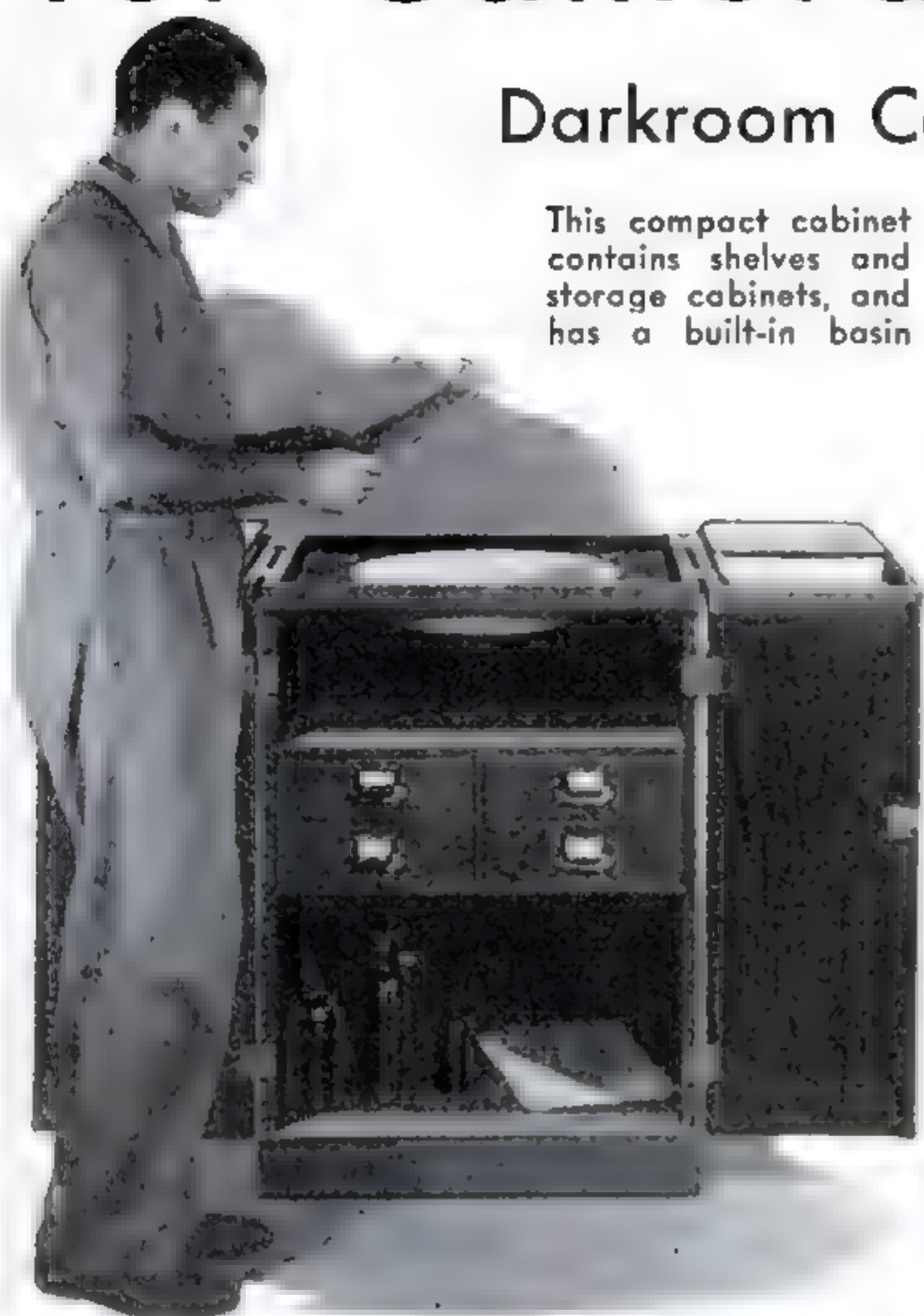


for Camera Enthusiasts

Darkroom Cabinet Needs Little Space

This compact cabinet contains shelves and storage cabinets, and has a built-in basin

ONLY three feet high, two feet wide, and a foot and a half deep when closed, a new photographic cabinet provides the amateur with darkroom facilities in compact form. Shelves and storage compartments within the cabinet hold chemicals, sensitized paper, and other materials, while the top of the cabinet contains a combined sink and print washer and two fifteen-inch porcelain trays.



Magnets Support Letters in New Titling Outfit

TINY magnets embedded in the backs of white letters form the novel feature of a new outfit for making home-movie titles. The magnets hold the letters in any desired position on a black iron background. With this accessory, it is easy, according to the manufacturer, to produce animated effects by moving the letters between exposures.



Letters stick in any desired position on background



The new enlarger in use. Drawing at left explains the novel illuminating system it employs



Reflected-Light Enlarger Keeps Heat from Film

REFLECTED light provides the illumination for a new thirty-five-millimeter enlarger recently placed on the market. By reducing heat, this feature is said to provide greater protection for films. Either single negatives or strip films are accommodated by the apparatus. The enlarger is sold with or without a lens. If no lens is purchased, the miniature camera used to make the photograph can be slipped in position on the apparatus and the enlargement made through its lens. Thirty by forty-inch pictures can be made with the new enlarger, it is reported.

Hunter Uses Blowgun To Kill Game



Walt Wilhelm, of Yermo, Calif., aiming his blowgun. It is a tube of copper nearly five feet long



Homemade darts used in hunting various kinds of game. These missiles have an amazing power of penetration



Loading the blowgun with a long, feathered dart. Note the steel tip

BLOWING homemade darts from a long copper tube, Walt Wilhelm, of Yermo, Calif., stalks and kills small game in near-by desert country. Using a variety of darts for ammunition, Wilhelm hunts birds, rabbits, ground squirrels, snakes, and lizards, firing his blowgun when he has approached within thirty feet of his prey. Unless he is able to aim the blowgun so that he can shoot his quarry through the head, he does not use the lung-powered weapon, since the darts, which strike with tremendous force, would pass completely through the body and only wound the animal. The blowgun Wilhelm uses is four feet, six inches long and five eighths of an inch in diameter. With it he has fired darts for a distance of 351 feet. At short range, he can drive the steel head of a dart so far into a board that it cannot be removed without the aid of a pair of pliers. Photographs reproduced on this page show various details of Wilhelm's sport.



Wilhelm demonstrates the remarkable accuracy of his weapon by some fancy shooting

Two tiny blown-glass monsters turned out by William Ball, who is shown pursuing his spare-time hobby in his cellar shop



Hobbyist Fashions Miniature Monsters from Scrap Glass

BLOWING miniatures of prehistoric monsters, tropical fish, and other creatures from colored glass is the interesting hobby of William Ball, of New York City. Practically any kind of glass serves as raw material for his spare-time occupation, including old bottles, colored marbles, and hard glass of the kind used in baking dishes. These scraps are melted down over a glass-blowing torch. Ball uses crucible tongs to hold the glass in the flame, pliers for squeezing it into shape, and scissors for cutting it while hot. The photograph at the left shows him at work at his glass-blowing table, while that reproduced above shows two tiny dinosaurs that he has modeled.

Office Communicator Is New Children's Toy

TWO-WAY communication from room to room within a house is provided by a practical child's toy modeled after inter-office communication systems now in general use. Powered by 110-volt alternating or direct house current, the outfit comprises two receiving-transmitting units connected by fifty feet of wire, although as much as 500 feet may be used if desired. The communicators are housed in synthetic-resin cabinets. Each is equipped with a double-throw switch which is held down for transmitting and up for receiving.



The toy operates like a regular inter-office communicator



Engineer reporting on tests by telephone from the refrigerated wind tunnel. Right, ice falling from a treated wing surface



Test New Ice-Preventing Paste for Planes

BATTLING the menace of ice formation on airplane wing surfaces, British aeronautical experts have been experimenting with an ice-preventing paste in a refrigerated wind-tunnel laboratory constructed in one of London's largest cold-storage plants. Intended to be

smeared on wings, rudders, and other exposed surfaces, the special paste does not actually prevent the formation of ice, but it does stop it from adhering to surfaces where wind and plane vibration can dislodge it before it becomes dangerous to sustained flight.

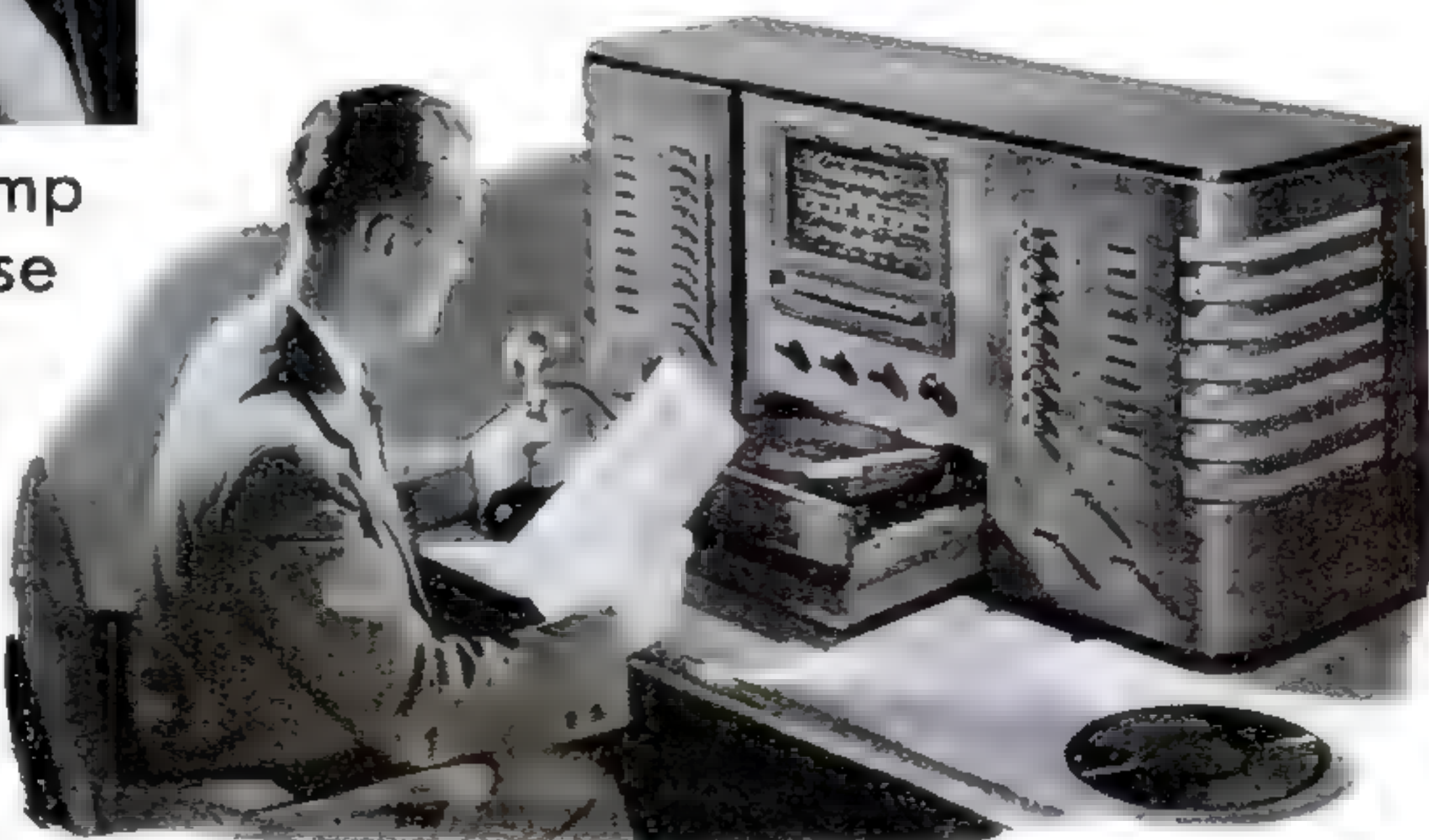


Hand Heat Lamp Is Easy To Use

SOOTHING infra-red rays are concentrated by a new hand-type heat-treatment lamp said to be valuable in relieving congestions such as sinus infections. Operating on either direct or alternating current, the ten-watt lamp is incased in a lightweight aluminum housing.

Control for School Sound System

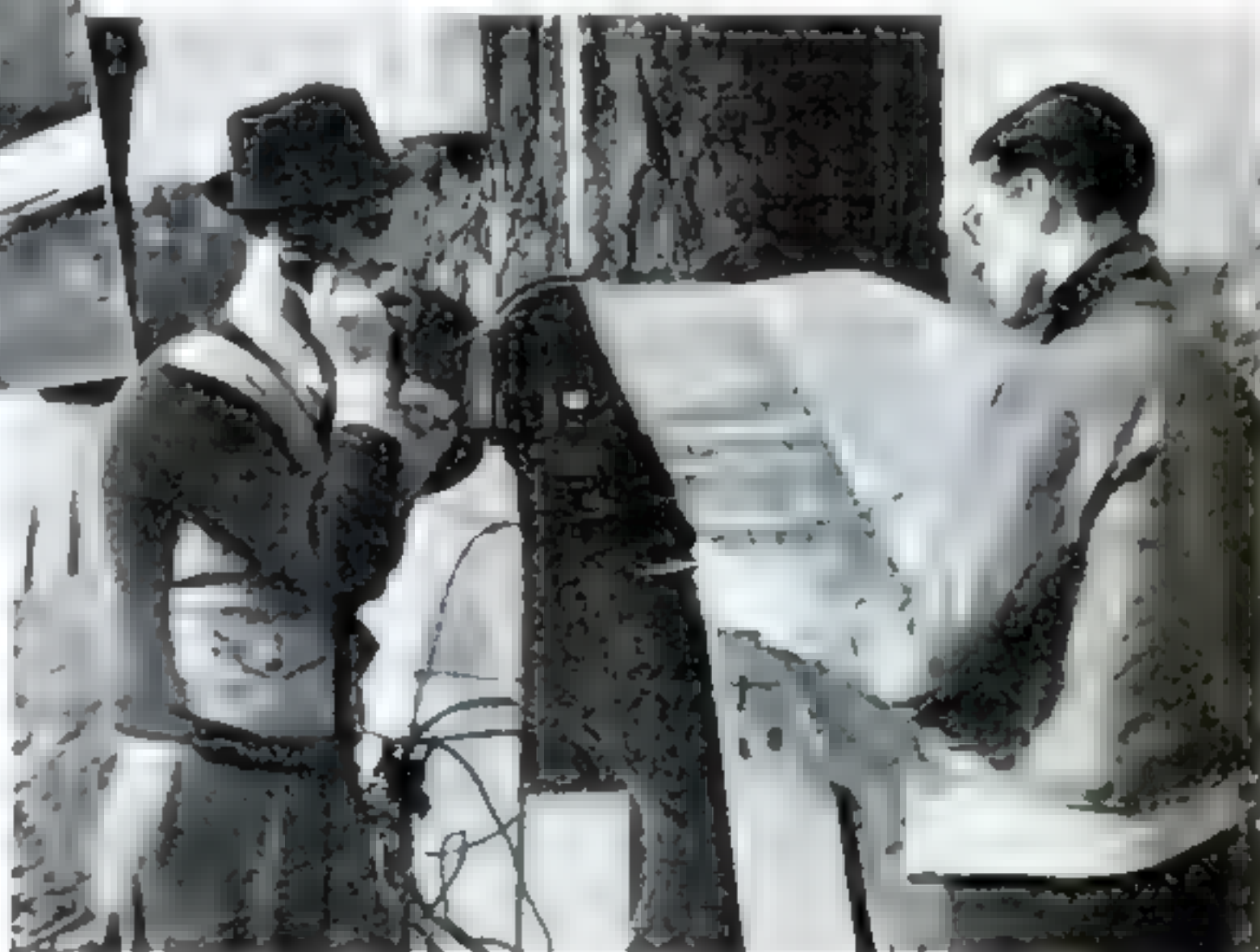
DESIGNED for school use, a new central control cabinet insures great flexibility in a public-address system. Consisting of a radio receiver, a phonograph turntable, a microphone, a monitoring loudspeaker, and switch controls for each of twenty classrooms, the unit permits a variety of operations. Two-way communications between the principal's office and any classroom can be made by throwing a single switch. Also, programs can be picked up and distributed.



This central panel controls all operations of a school public-address system



In the picture above, the circle shows one of the five loudspeakers scattered about the big building site. Left, microphone at headquarters



Loudspeaker System Directs Builders

LOUDSPEAKERS, microphones, and field-telephone sets forming an independent communication system are being used to speed construction operations at a mammoth \$2,000,000 apartment-house development in Plainfield, N.J. A microphone placed in construction headquarters connects with five loudspeakers strategically placed in trees within the twenty-six-acre building tract. Telephone instruments have also been installed at various points and connected with

An engineer receiving instructions over a field telephone

the central office. Thus general orders can be quickly broadcast by headquarters to groups of workmen at various locations on the site, and consultations between field engineers and the headquarters staff may be carried on at any time by telephone. When completed, this huge development will consist of fifty apartment buildings containing 1,150 rooms.



Nurses practicing with a doll which actually has footprints. Right, Mrs. Mary E. Hamilton and some pupils of her unique school



Women Learn Fingerprinting at School

NURSES, school teachers, and policewomen are taught the technique of fingerprinting and footprinting at a unique school for women operated by Mrs. Mary E. Hamilton, who was New York City's first policewoman. Most pupils take an intensive course lasting three months, although specially serious stu-

dents can spend as much as three years learning the many ramifications of the subject. Mrs. Hamilton believes that the increasing use of fingerprints and footprints as means of identification offers a wide field of employment for women because of the detailed and painstaking work involved.



British Army officer fording a stream in a recent motor-cycle endurance test

Motor Cycles' Mettle Tested in Novel Race

SWIRLING rivers, mud holes, steep hills, and wooded trails were some of the obstacles in a motor-cycle endurance test recently conducted by British Army officials in Hampshire, England, to check the performance of various makes of machines. Starting from the military base at Aldershot, more than 100 army officers and men carrying full wartime equipment rode their roaring motor cycles at top speed through the bogs, streams, and other physical barriers along the stiff course.

Desert Gas Station Is Lonely Outpost



A modern desert ship calls at the lonely outpost for fuel. Below, a view of station from beacon tower

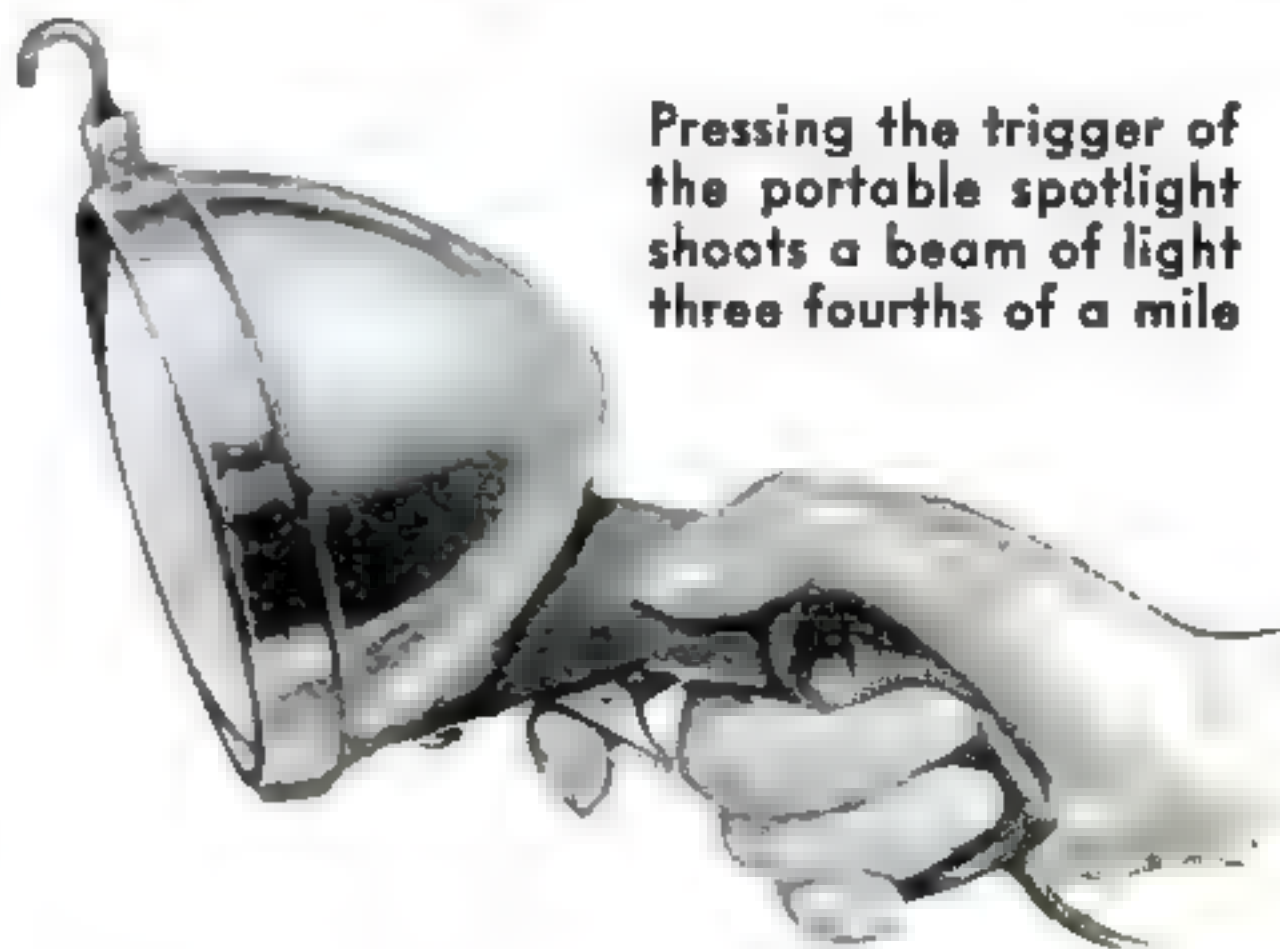


SURROUNDED by hundreds of thousands of square miles of lifeless sand, the keeper of a gas station and lighthouse in the middle of the Sahara Desert has the world's loneliest job. His lighthouse guides planes and motor coaches of the trans-Sahara traffic to a gasoline depot where they can obtain fuel. Once a week, a machine stops for an hour at the cache. But for long periods, the keeper is

alone, the only human being in 750,000 square miles of sand. Within the hut where he lives, the temperature frequently rises to 140 degrees Fahrenheit during the day and drops to thirty-five degrees at night. The present lighthouse keeper is the fifth man to hold the job. One of his predecessors died of fever, a second perished in a gasoline explosion, a third went insane, and a fourth died of thirst.

Spotlight Has Pistol Grip

SHOOTING a beam of light three quarters of a mile, a new pistol-type spotlight is available for use by police and fire officials, sportsmen, campers, motorists, telephone linesmen, and railroad crews. The light is held by a pistol grip and is turned on and off by means of a trigger. Electricity is supplied to the lamp either by an automobile battery, house current, or by a compact portable battery supplied by the manufacturer. The latter is carried with a shoulder strap.



Pressing the trigger of the portable spotlight shoots a beam of light three fourths of a mile

Worms That Turned ... into Money



Angleworms with their eggs. In circle, worms are emerging as jellylike strings from two eggs. Left, R. B. Bilkosky with some of his odd crop

BURSTING out of their tiny, grapelike eggs like hatching chickens, billions of angleworms are reared to maturity on the novel farm of R. B. Bilkosky at Alhambra, Calif. Others from his fertile back yard stock 100 worm farms from Oregon to Florida. All thrive on a simple diet consisting largely of newspapers, iron, and water.

Bilkosky started his unusual undertaking ten years ago. For two years he experimented, learning to keep worms alive in cans.

Then he launched into the double business of supplying worms to anglers and starting similar farms for others. Once he shipped eight barrels—1,000,000 worms—to a farm in San Antonio, Tex. That same year he made a mistake in feeding and lost 15,000,000 worms from poisoning. Cleaning out the beds, he replanted and has suffered no serious loss since.

Alhambra's "worm man," as he is called, stimulates reproduction by feeding and watering. He spades under the earth batches of newspapers, which the worms consume along with walnut-shell meal, alfalfa, iron, and plain fertilizer. Both males and females lay eggs, each yielding two worms. Breeders are sold to worm farmers, while others go to fishermen. The worms remain within two inches

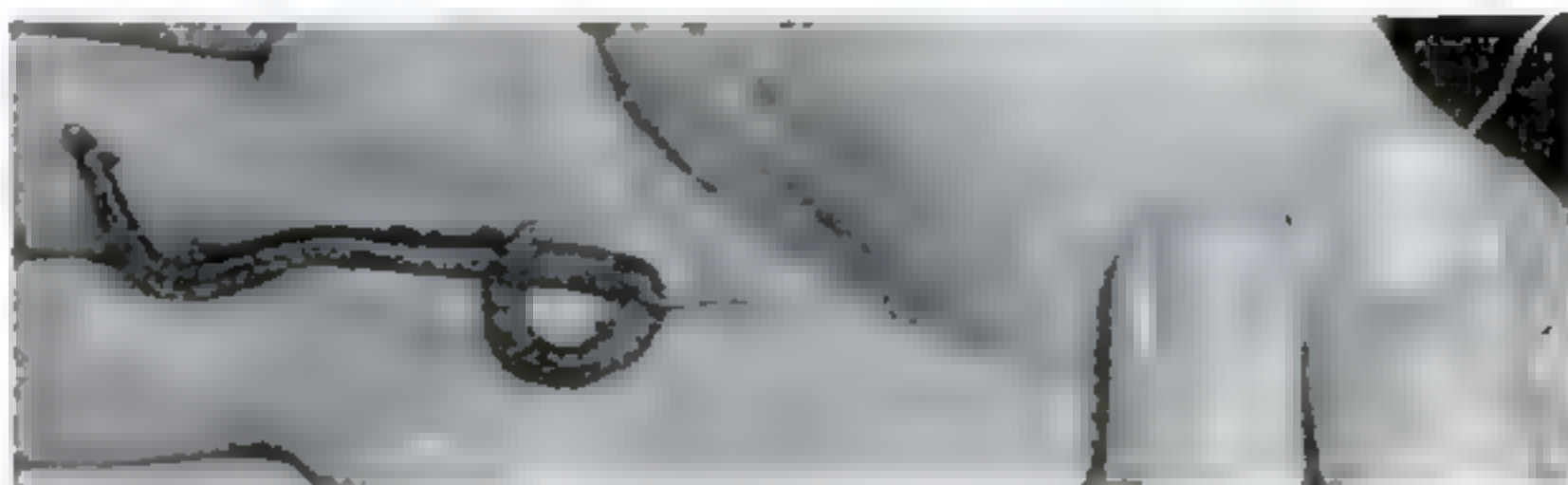
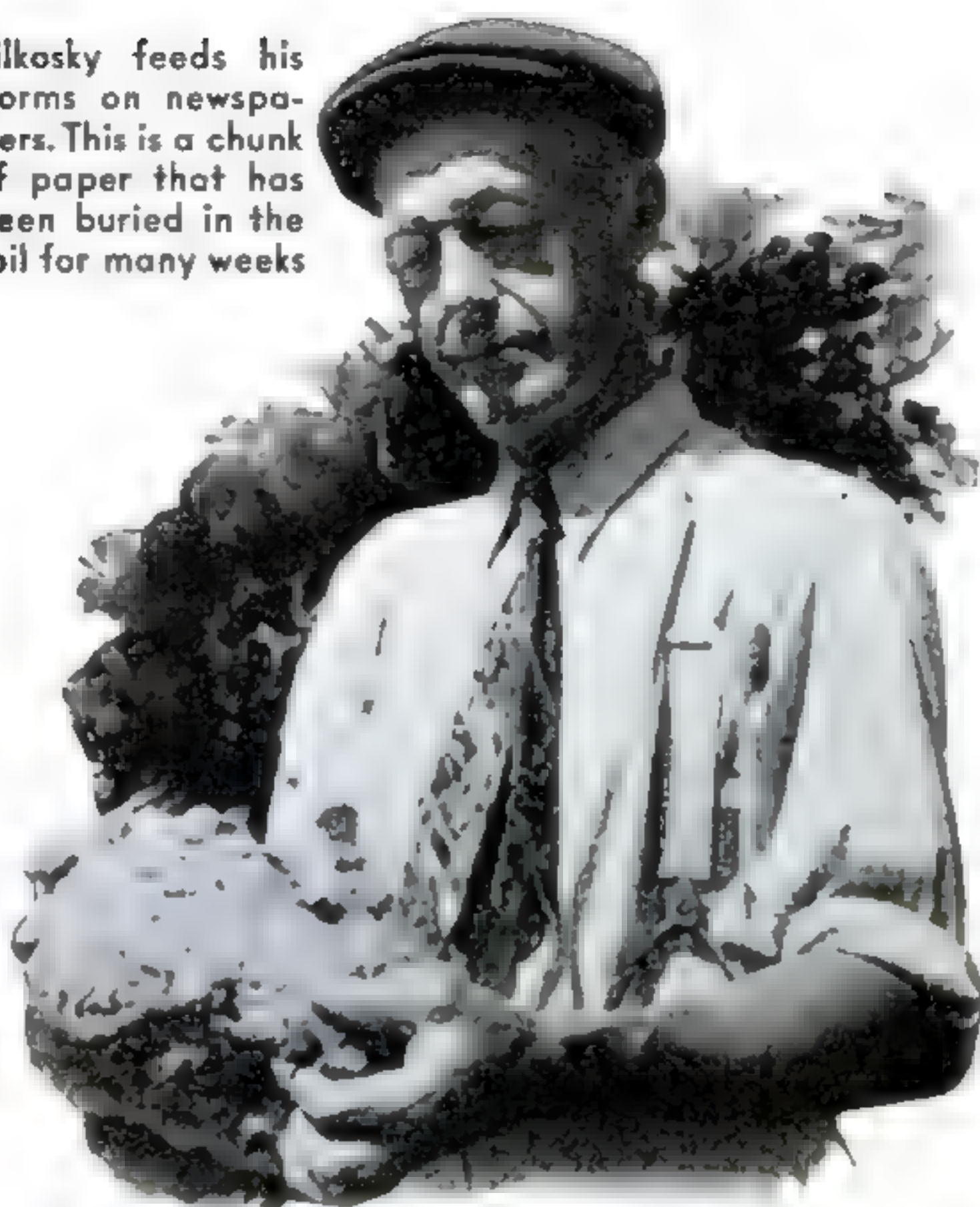
of the surface when breeding, each laying 400 eggs a year. Mother and father remain with the eggs until they hatch, which occurs a week after laying. Hatching worms, as these pictures show, emerge like strings of jelly. A week later, they are large enough to serve as bait on small hooks.

Some of his worms, Bilkosky says, are ten years old and still laying. There's no reason, in his opinion, why they should not live to fifty. Under an enlarging glass, he has counted five hearts and 180 kidneys in a single worm. He has his own system for baiting.



This picture shows how densely the worms grow. Right, Bilkosky's baiting method—a single loop put over a No. 16 fishhook

Bilkosky feeds his worms on newspapers. This is a chunk of paper that has been buried in the soil for many weeks



CASH PRIZES FOR QUEER JOBS

WHAT an odd way to make a living—raising angleworms! It is a queer job. But, there are other occupations even stranger. In your own community, some one probably is making a living in an unusual way. If so, here's your chance to make money by telling us how he makes money!

It's easy. Just write us a letter of not more than 500 words giving the details of the queerest job you know, and accompany it with a photograph of the subject at work. For the best letter and photograph received describing the queerest job, we will pay \$50.00 in cash; for the second-best letter, \$25.00; and for the five next-best, \$5.00 apiece. You don't have to be a trained writer to win. All you have to do is know

some one with a queer job and tell us what it is, how it started, and all the details that you think would be interesting to readers of this magazine.

The contest is open to every one, except employees of **POPULAR SCIENCE MONTHLY** and their families. The judges will be the editors, and their decisions will be final. In the case of a tie, each tying contestant will be awarded the prize tied for.

Address your letters to the Queer Jobs Contest, **POPULAR SCIENCE MONTHLY**, 353 Fourth Avenue, New York, N. Y., and be sure to mail them before midnight on January 31, 1939, the date when the contest closes. No entries will be returned, and all entries become the property of **POPULAR SCIENCE MONTHLY**.

New Weatherproof Paint Can Be Put On in Rain

WHETHER a surface is wet or dry makes no difference to the user of a new moisture-absorbing paint, which can even be applied during a pouring rain! Available in all colors, and in types suitable for outdoor and indoor use, the novel painting material may be applied to wood, metal, brick, stone, plaster, and wall board. According to the maker, the resulting coating is waterproof and rustproof.



Note how paint smooths out, even on a wet surface



Device Removes Moisture from Refrigerating Units

TO ELIMINATE unwanted moisture in refrigerating and air-conditioning systems, a new accessory employs a replaceable cartridge containing a standard dehydrating agent, such as granules of calcium chloride. Air or a liquid refrigerant loses every trace of water as it passes through the cartridge, until prolonged use reduces the drying efficiency of the chemical. Then the spent cartridge is removed by taking off one end of the unit, and a fresh cartridge is substituted, as above.

Photographer Risks Injury To Snap Blazing Racing Car

AS A midget racing car skidded by him in flames, across a Los Angeles speedway, a daring photographer risked being struck to snap the spectacular picture below. Within

the torch on wheels, the driver may clearly be seen trying to extricate himself from his narrow cockpit. A moment later, seriously burned, he leaped from the car.

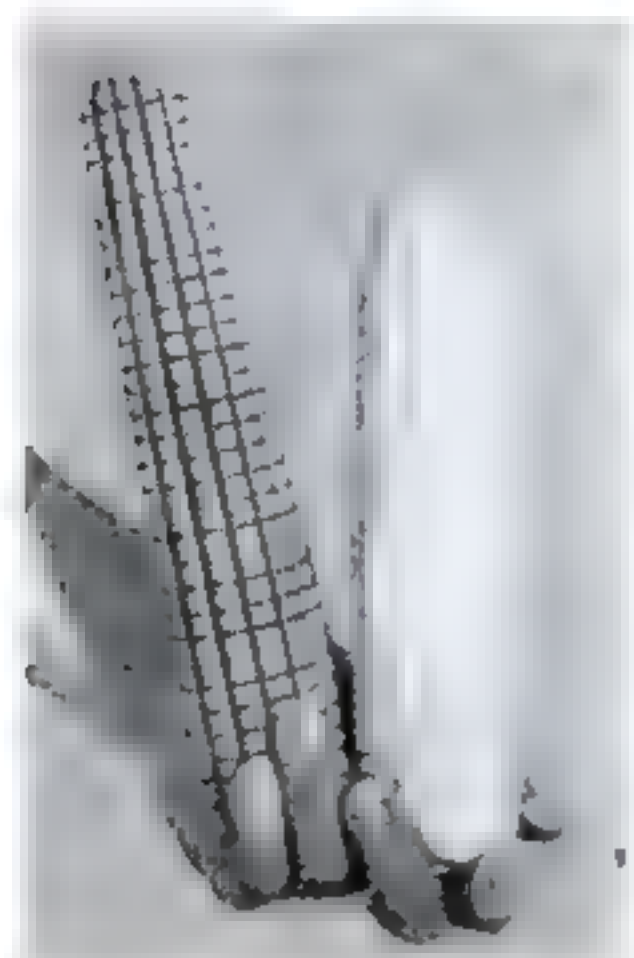


As the racing car roared by enveloped in a sheet of flames, the photographer caught this amazing picture

Cut-Out License Numbers Shine Through Fog

AUTOMOBILE license plates that would be visible through fog are proposed by Charles and Joseph Chalmette, California inventors. Registration numbers are cut out of the metal plates, which are inserted in front of amber glass backed by electric bulbs and reflectors.

Dummy Corn Decoys Ducks



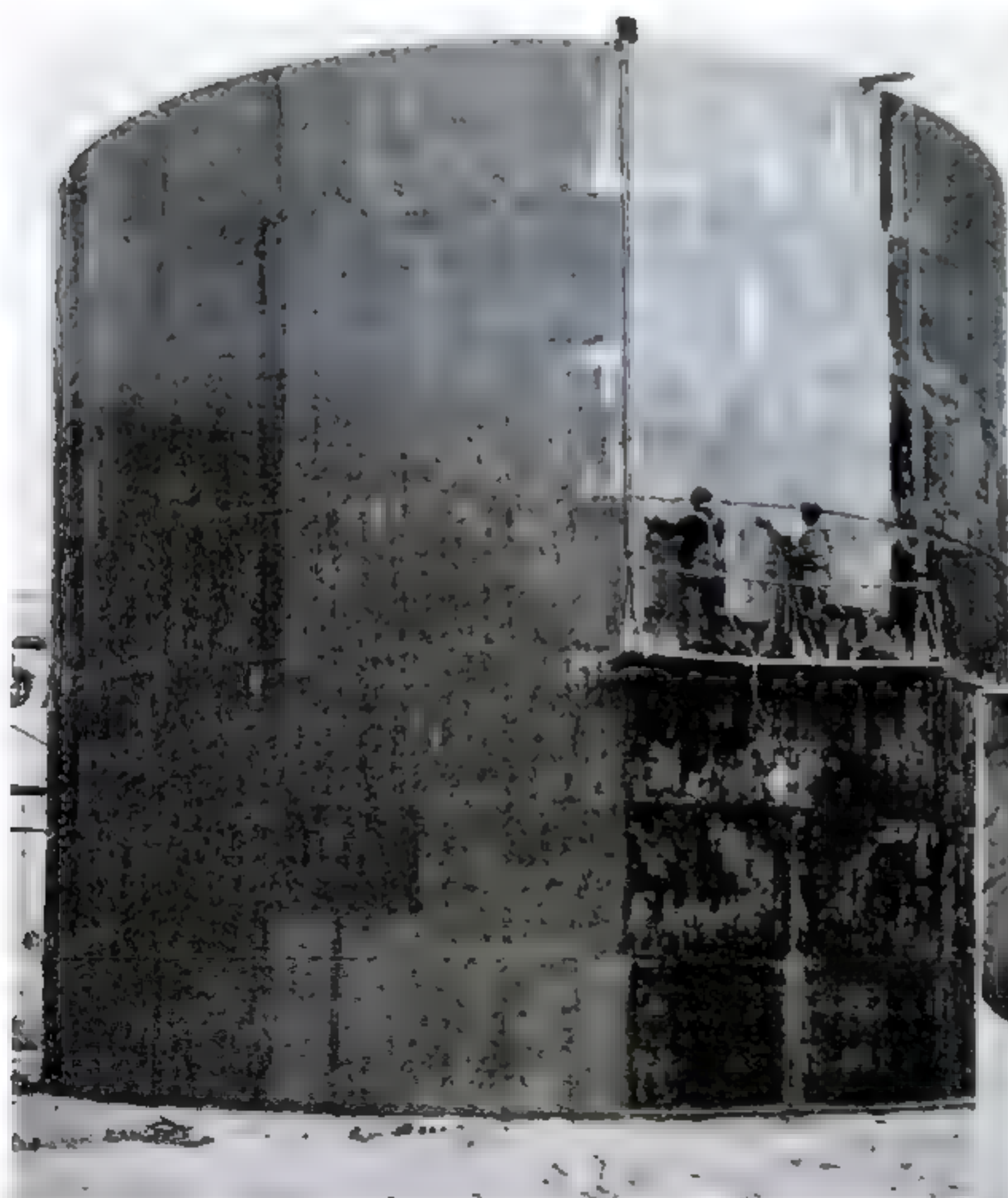
ARTIFICIAL field corn is now available to hunters for spreading around feeding areas to lure wild ducks within shotgun range. Turned and carved from processed maple, the realistic bait is coated with a special protective lacquer. The decoy, which is legal, is compared with a real cob of corn at the left.



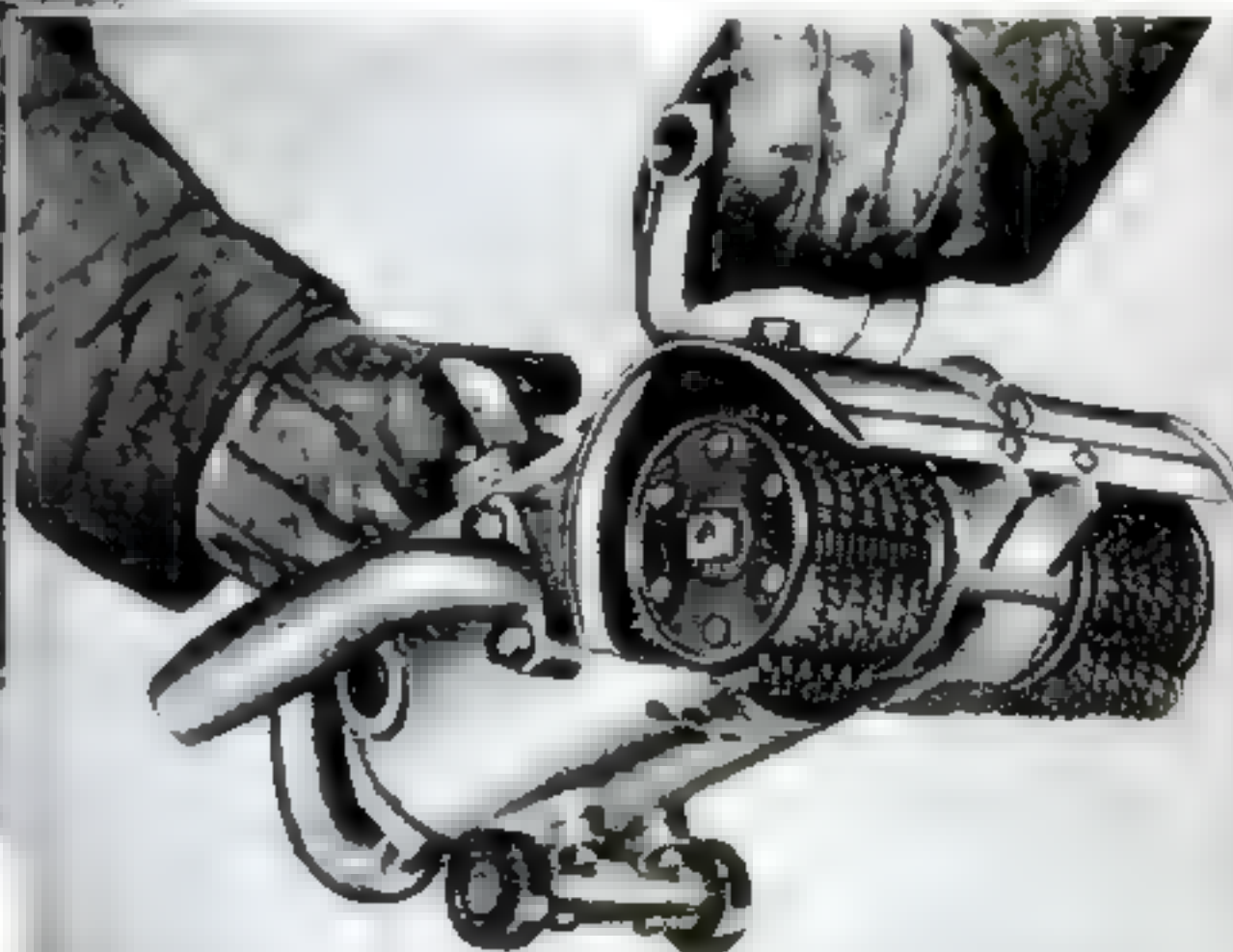
Yellow light shines through the cut-out numerals

Electric Blaster Cleans Stone or Steel

PAINT, scale, and other accumulations are economically removed from metal or hard stone surfaces by an electrically powered machine just introduced. Whirling rapidly, groups of loosely mounted, toothed wheels are thrown outward by centrifugal force, contact the surface to be cleaned at the rate of over 100,000 times a minute, and shear away all stains, paint, or rust. The machine operates on either alternating or direct current. A lighter model is driven by compressed air.



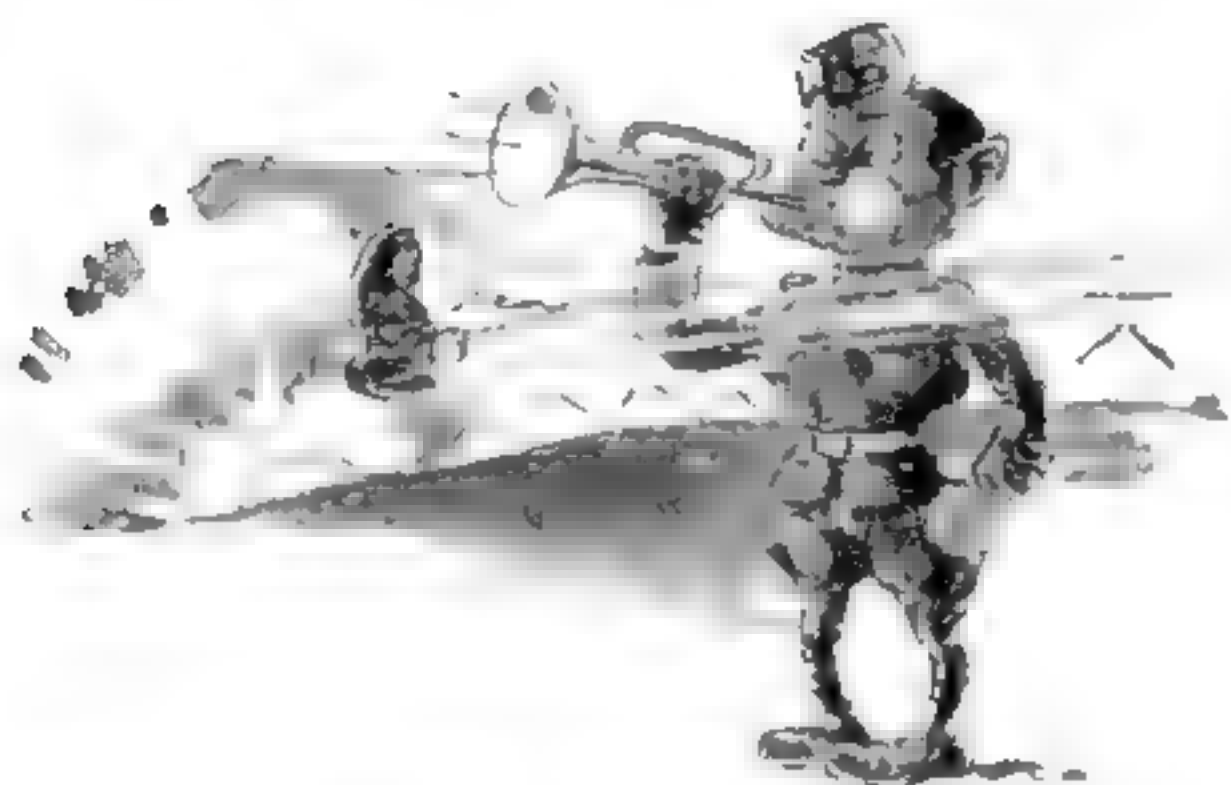
Workmen using the mechanical blasters to remove rust and paint from a tank. The tool is seen at the right



POPULAR SCIENCE

Question Bee

There is one true statement in each of the numbered paragraphs below. Can you separate it from the surrounding camouflage? Note your results and compare them with the list on page 250



- 1 With a keyless instrument like the bugle, the various notes are played by sounding the (a) undertones (b) overtones (c) half tones (d) ketones.
- 2 Approaches to modern fortifications are defended with the aid of (a) Lyle guns (b) party walls (c) tank traps (d) placer mines.
- 3 Canis Major is (a) one of your front teeth (b) a felony formerly punishable by death (c) the Latin name for the great Dane (d) a constellation containing the star Sirius.
- 4 Wind a number of turns of insulated wire around a core of soft iron and you will have (a) a condenser (b) a lightning arrester (c) an electromagnet (d) a short circuit.
- 5 Automobile motors of recent years have employed increasingly high (a) gear ratios (b) aspect ratios (c) fineness ratios (d) compression ratios.
- 6 Seven hundred and forty-six watts is equivalent to one (a) foot pound (b) kilowatt (c) horsepower (d) dyne.
- 7 Trypanosomes (a) cause sleeping sickness (b) contain the genes of heredity (c) were the forerunners of present-day lizards.
- 8 Ironwork to be painted first receives a protective coat of (a) blue vitriol (b) red lead (c) yellow prussiate of potash (d) green salt of Magnus.
- 9 Airplane pilots are guided along cross-country routes by (a) beam compasses (b) radio beacons (c) pilot lights (d) magnetic chucks.
- 10 One of the most serious of insect pests is the (a) praying mantis (b) Luna moth (c) Japanese beetle (d) cork borer (e) jitterbug.
- 11 Cave dwellers who lived in the southwestern United States thousands of years ago are known as the (a) basket makers (b) pot boilers (c) fire walkers (d) lotus eaters (e) road runners.
- 12 Just as you pass in a speeding train, the ringing of a crossing bell (a) momentarily ceases (b) seems to be coming from all directions (c) becomes a hissing noise (d) drops in pitch.
- 13 Exterior rods that brace airplane wings are called (a) spanners (b) struts (c) pylons (d) flying buttresses.
- 14 What happens when Mercury or Venus crosses the face of the sun is not an eclipse but (a) a transit (b) an equinox (c) a culmination (d) a perigee.
- 15 You could make steel by the (a) Ben Day process (b) Haber process (c) Bessemer process (d) mastoid process.
- 16 Hunters of another generation are believed to have exterminated the (a) Canada goose (b) passenger pigeon (c) English sparrow (d) traveling crane (e) round robin.
- 17 Discovery of a new isotope would interest the (a) International Astronomical Union (b) National Zoological Park (c) American Chemical Society (d) U. S. Coast and Geodetic Survey.
- 18 An important raw material in the manufacture of chewing gum is (a) lignite (b) guayule (c) galena (d) chicle.
- 19 Light that vibrates in only one plane is said to be (a) diffracted (b) polarized (c) convected (d) ionized.
- 20 A first-class home workshop would be likely to possess (a) a plane table (b) a drop hammer (c) a drill press (d) a Fourdrinier machine (e) parallel bars.

Un-Natural History

By GUS MAGER

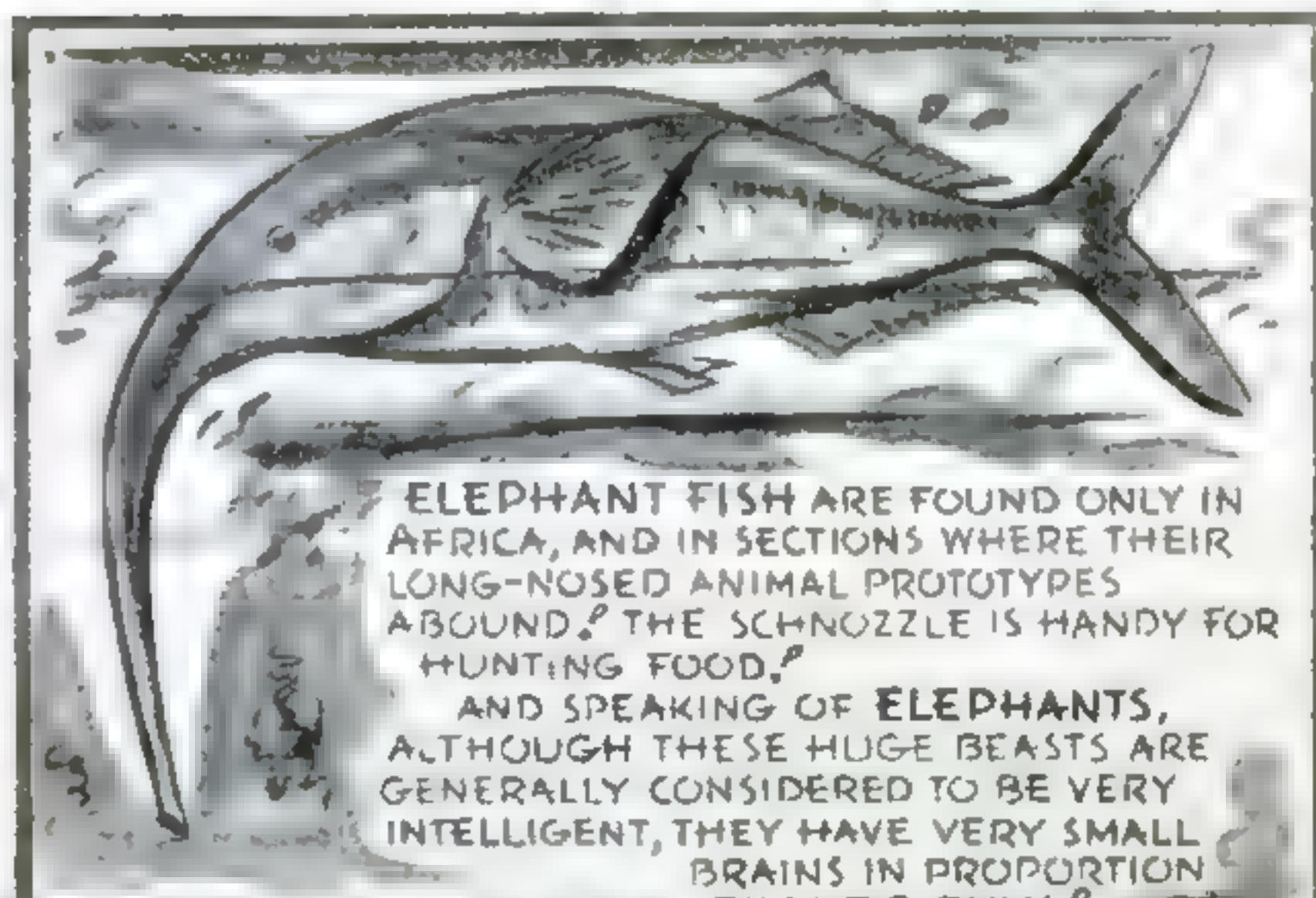
THAT TERRIFYING HEAD ON THE LANTERN FLY, WHICH LOOKS LIKE THE BUSINESS END OF AN ALLIGATOR, IS ONLY A HOLLOW MASK, WITH FAKE EYES AND A DOUBLE ROW OF FALSE TEETH. IN SPITE OF ITS NAME, THIS TROPICAL INSECT IS NOT LUMINOUS.



BUT THE FIRE BEETLE, ALSO OF THE AMERICAN TROPICS, IS ACTUALLY A FLASH-LIGHT FLY. ITS HEAD LOBES FLASH A BRIGHT GREEN FIRE. NATIVES COLLECT THEM IN A BAMBOO STEM AND WHEN THE TUBE IS TAPPED THE LIGHT FLASHES ON.

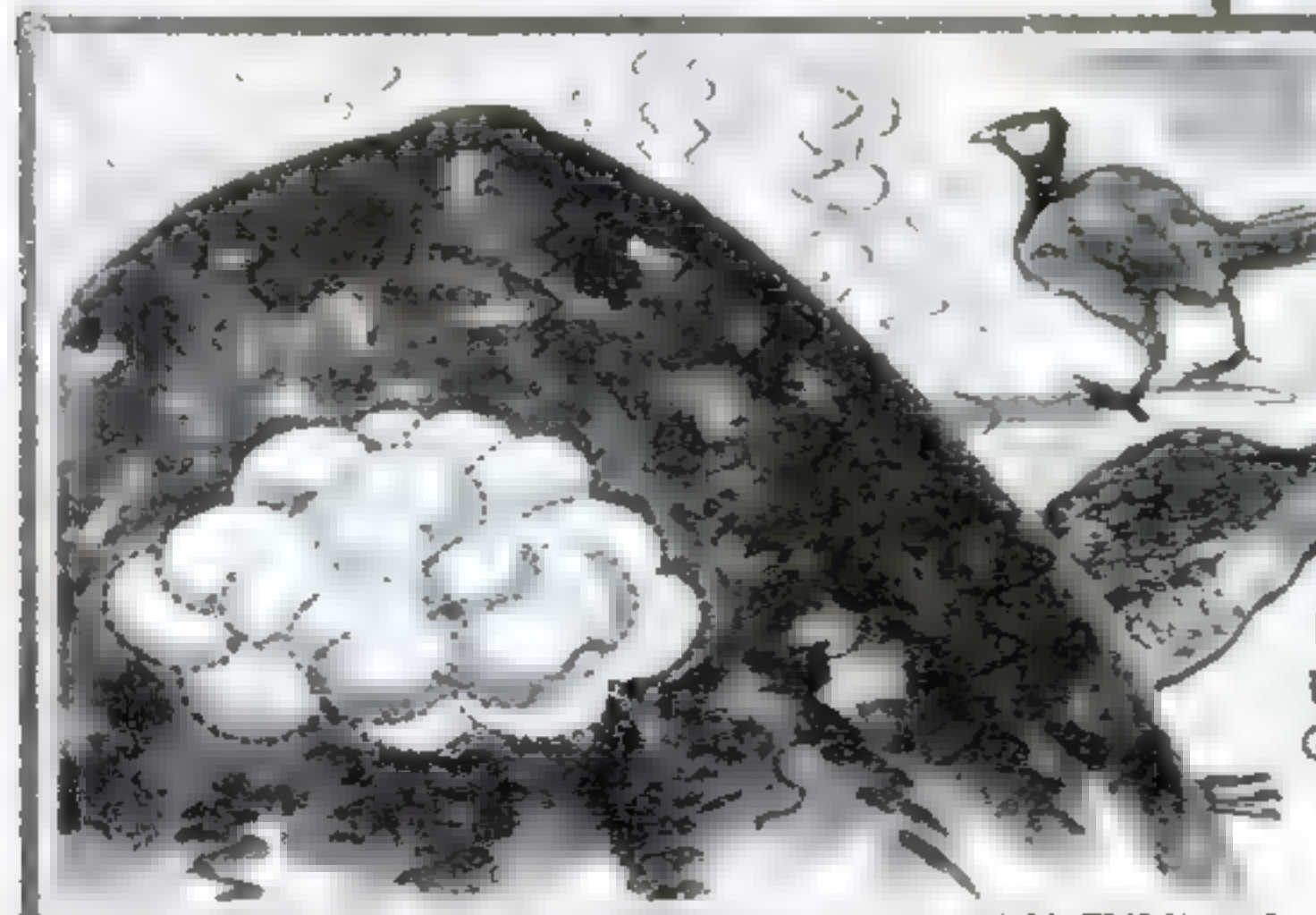


NO TRUE FISH IS THE LAMPREY EEL, BECAUSE HE HAS NO BONES, NO GILLS, AND NO PAIRED FINS. HIS ONE NOSTRIL IS A BLIND SAC. WITH HIS ROUND, SUCKING MOUTH HE CLINGS TO ROCKS AND GATHERS FOOD.



ELEPHANT FISH ARE FOUND ONLY IN AFRICA, AND IN SECTIONS WHERE THEIR LONG-NOSED ANIMAL PROTOTYPES ABOUND. THE SCHNOZZLE IS HANDY FOR HUNTING FOOD.

AND SPEAKING OF ELEPHANTS, ALTHOUGH THESE HUGE BEASTS ARE GENERALLY CONSIDERED TO BE VERY INTELLIGENT, THEY HAVE VERY SMALL BRAINS IN PROPORTION TO THEIR BULK.



LEIPOA BIRDS OF AUSTRALIA CAN'T BE BOTHERED WITH SITTING ON THEIR EGGS. INSTEAD, THEY BUILD AN AIR-CONDITIONED INCUBATOR OF ROTTING VEGETABLE MOLD, AND LAY THEIR EGGS INSIDE. HEAT GENERATED BY THE ROTTING MOLD DOES THE HATCHING.



Household



STOOL AND WASHBASIN are combined in this handy piece of nursery furniture. The basin rises to a convenient height for washing when the cover is removed, as pictured above

KNEE-ACTION PEELER. The pivoted blade of the peeler below follows the contours of vegetables and fruits to give a paper-thin paring



CREAM PUMP. Cream can be pumped from any desired level of a bottle of milk with the device seen below. Pressing the bulb forces the cream through the spout



JELLY METER: To find out how much sugar is needed to make jelly, the tube seen at the left is filled with the extracted juice. Juice is then allowed to run out for a minute, and the change of level is noted. Markings show sugar required

Appliances

ASH-TRAY LININGS

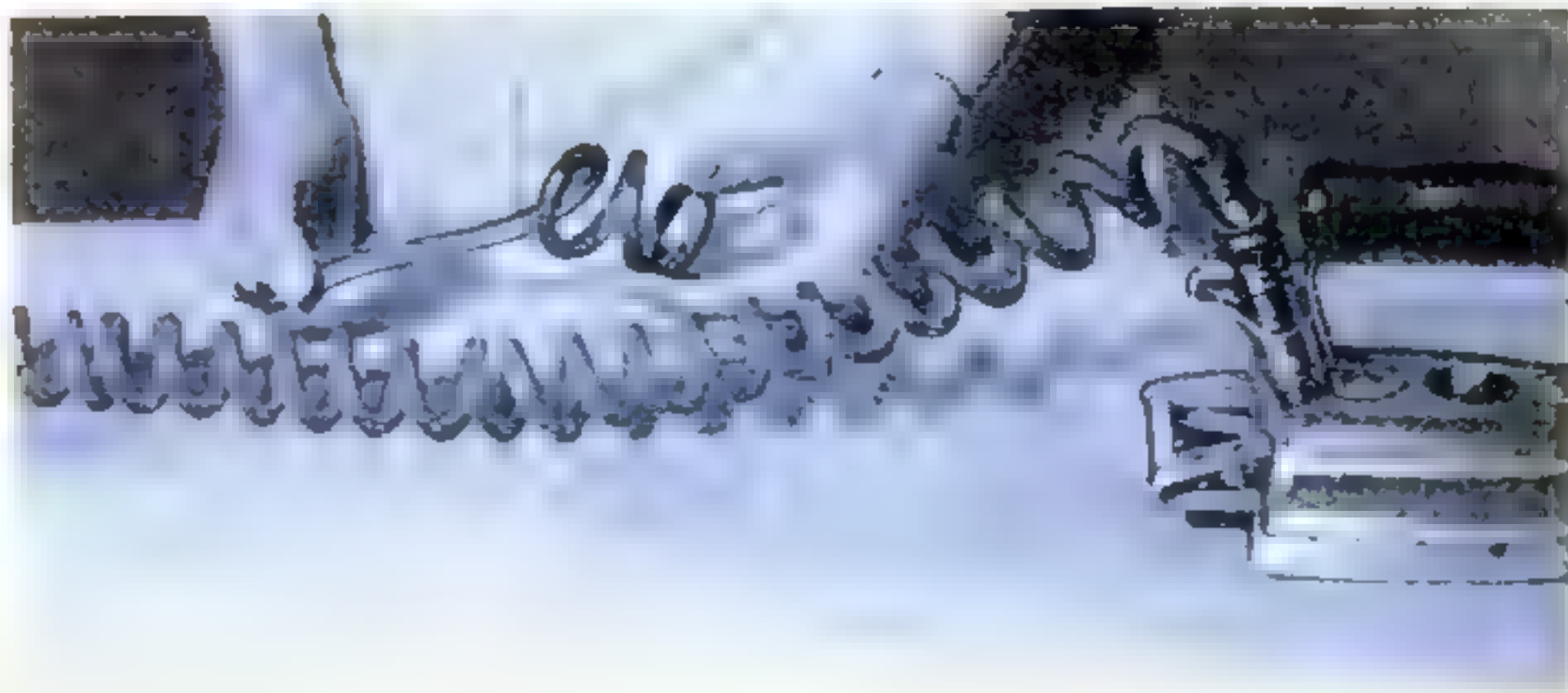
Nested cups of chemically treated paper are now supplied with ash trays. When filled, they are lifted out and thrown away, eliminating the usual stale, musty odor



AUTOMATIC PANCAKE TURNER. Pancakes, hamburgers, and similar foods are easily turned with the novel "flipper" illustrated below. When the two wires forming the handle are squeezed, the metal plate turns, flipping the food over



COILED EXTENSION CORD
Molded into a coil as shown at right, without metal springs or other covering, an extension cord for electrical appliances stretches out as required and then springs back when released



WARDROBE RACK
Easily installed in any closet, the steel rack shown above provides a hanger bar, tie rack, shelves for shoes and hats, and a storage shelf. It folds, as at left



Gus Plays

FAULTY WHEEL ADJUSTMENT



"Seen any suspicious cars?" Jerry asked. Gus jerked a thumb toward a blue sedan

TROOPER Jerry Corcoran of the State Police sauntered into the shop of the Model Garage one mild winter afternoon. Giving Harry, the grease monkey, a playful poke in the ribs and grinning cheerfully at Gus and at Joe Clark, he perched himself on the end of the workbench.

"Seen any suspicious characters around lately, Gus?" he asked.

"Not a one—except Joe here, and Harry," Gus told him.

"I always keep an eye on both of them," Jerry said. "Or any suspicious cars, Gus?"

Gus jerked a thumb toward a blue sedan

"I'm suspicious of that one," he said. "I suspect it's got a bad case of steering trouble."

"Steering trouble!" Interest edged the trooper's voice. "Who's car is it?"

Gus laughed. "Henry Miller—you know him—pays the repair bills on it. And he pays plenty! His wife drives it, and she can do more and worse things to a car in a shorter time than any other woman I've ever seen."

Jerry fished a package of cigarettes out of a pocket of his tunic and lighted one. Then he looked hard at Gus, tilted his head toward Harry, and winked.

Gus took the hint. "Darned if I'm not all out of pipe tobacco," he remarked. "Hey, Harry—do me a favor, will you? Hop on your motorcycle and go down to Kerr's and get me a half-pound can of

'Delight.' Here's the money."

Harry went out, and they heard him roar away down the road.

"Well, what's on your mind?" Gus asked the trooper.

"Just among the three of us," Jerry said. "Right?" Gus and Joe nodded. "You fellows know Silvio Scarpati? Italian—about forty-five—weighs close to 300 pounds.

"Yes, I know him," Joe Clark said. "He comes in here sometimes. Always pays cash."

Gus nodded. "Not a bad sort of fellow," he added.

"We haven't got anything against him,"

Detective

By
MARTIN BUNN

HELPS TO SOLVE A KIDNAPING

Jerry said tolerantly. "He used to be a beer-runner, and made a pile out of it, but that's none of our business now. After repeal he bought ten acres with a house on it over on the dirt road, about a mile beyond Griggs's store. He's never done a lick of work since he quit beer-running—just sits around all day and gets fatter and fatter."

"Well, that's his privilege, if he's got the money," Gus said.

"Sure it is," Jerry agreed. "The trouble is, he's been snatched."

"Snatched!" Joe Clark exclaimed. "You mean kidnaped?"

Jerry nodded. "Last night, after it stopped raining—say about three o'clock this morning. Silvio's wife and kids were down in New York, visiting her people. The hired man—he sleeps in a shack back from the house—says he heard a row, and a car drive away. Plenty of signs of a scuffle in the path in front of the house. Tire tracks in the dirt road—made after the rain stopped."

"That's too bad," Gus said. "But why are you so steamed up about it? Kidnaping—that's a job for the G-men, isn't it?"

"They're working on it," Jerry said. "And so am I. If I can show that Silvio was taken

across the state line, the G-men will be able to get on the job in a really big way."

From his breast pocket the trooper took three small rolls of stiff paper. "Remember that road that Silvio lives on, Gus?" he asked. "About a half mile this side of his house there is a short stretch of cement road. Well, I told you there were tire tracks in front of Silvio's house. I picked up those same tracks where the cement road starts, and I took some pictures of them—the sticky black mud on the tires made that easy." He spread out one of the rolls, and handed it to Gus. "Here they are—pieced together, and enlarged. What do you make of them?"

Gus took the long, narrow print under a drop lamp, and examined it for a couple of minutes before he spoke.

"All I can make of it," he said at last, "is that the car wasn't steering properly. It was shimmying—there was so much up-and-down vibration of the front wheels that sometimes they were right off the road. Oh, yes—and the driver kicked his brakes on hard."

Jerry handed him another print. "How about this one?"

"Same tires," Gus said after an intent examination. "But the car wasn't shimmying. It was wandering—you know, tending to weave from one side of the road to the other."

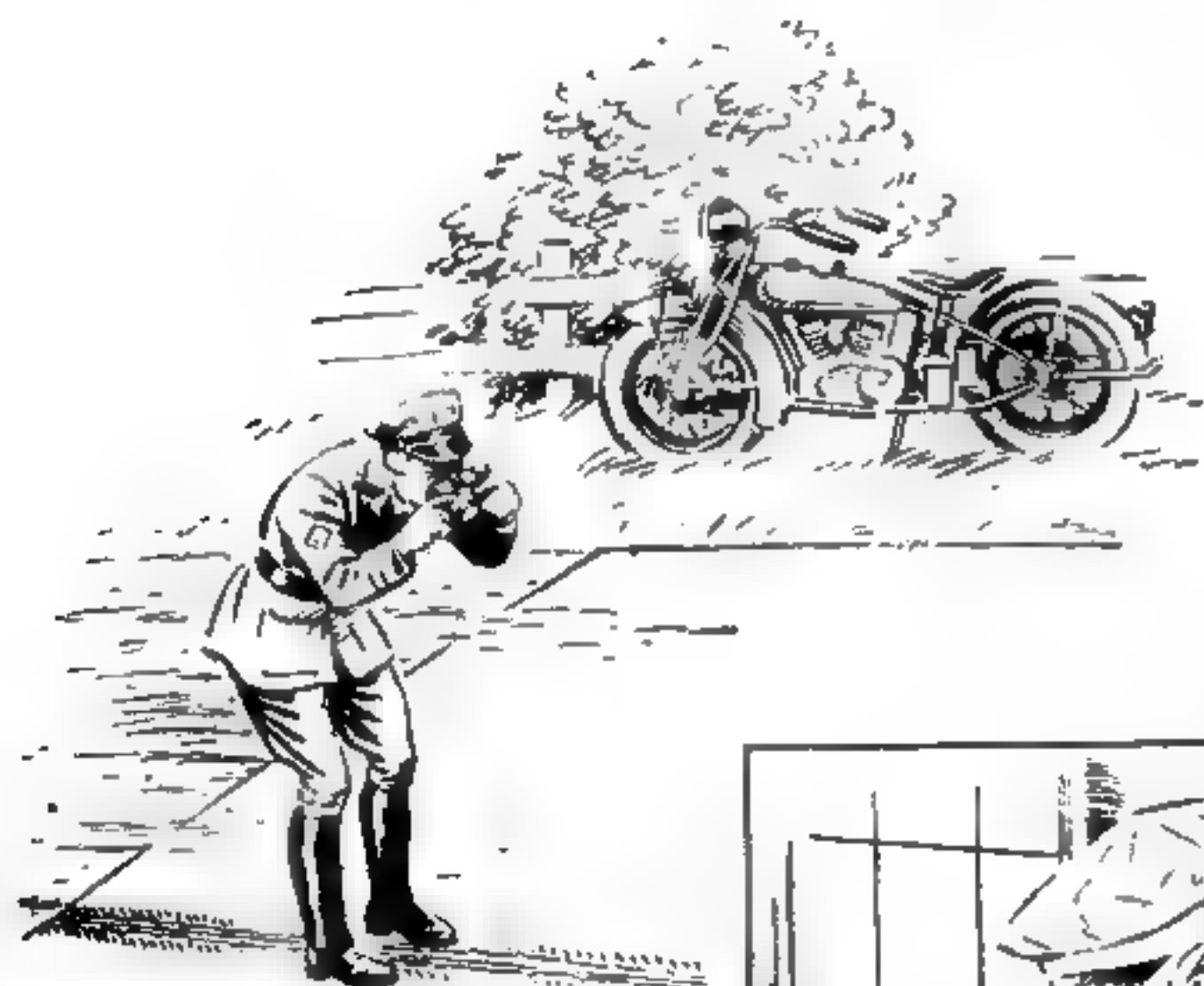
The trooper nodded. "This is what those pictures prove," he said. "That car was driven from Silvio's house onto that stretch of cement road. When it got there, its front wheels were shimmying. The driver stopped the car suddenly. Then he went on again—but now his front wheels were wandering. What I've got to know, Gus, is what happened while the car was stopped—what happened

to stop the shimmying and start the wandering?"

For a good three minutes no one said anything. Then Gus asked: "Do you know what caster is, Jerry?"

"I think I do," Jerry said. "But you tell me, professor!"

"Well," Gus said, "you know how a furniture caster is



TIRE PRINTS GIVE CLEWS TO A CRIME

"I took some pictures of the tire tracks. Here they are, put together and enlarged." Gus took the long print and examined it before he spoke



made, don't you?—with the center of the wheel set off the line of the pivot, so that no matter in what direction you push a piece of furniture, the caster will turn and follow the line of its pivot. To make any automobile steer properly, they have to get the same effect in its front axle. They do it by tilting the axle when they mount it on the front spring. Road conditions, and the amount of weight the car is carrying, cause frequent changes in the curvature of the front spring, and these changes result in changes in the caster angle. When these changes in caster angle go beyond reasonable limits, they affect the steering of the car. Too little caster causes wandering, and too much caster causes shimmying.

"Now, Jerry, what you want to know is what happened to the kidnap car while it was standing still, to stop it shimmying and start it weaving. Only one thing could have done that. A considerable weight must have been taken out of the car. Removing that weight decreased the caster enough to make the front wheels wander and weave when the car was started."

Jerry grinned. "That's what I wanted!" he exclaimed. "Silvio weighs close to 300 pounds. Probably two men were guarding him—say they weighed 150 each. That makes 600 pounds. Would that be enough to change the caster, Gus?"

"It might," Gus assured him. The trooper handed him the third print. "Nothing on this," Gus said. "Different tires—almost new. Steering O.K."

"Those are the tracks of a car that was standing at the side of the road," Jerry said. "The other car stopped beside it. Then this car went on—headed for the state line, only ten miles away. That'll be enough to satisfy the G-men! I think I know the fellow who drove the first car—we've been watching him for months, and we've got plenty on him. Now I'm going to check up on his car."

"The chances are about fifty to one," put in Gus, "it will have weak front springs."

"Thanks, Gus!" Jerry said, starting for the door. "I'll be seeing you!"

"Now that I've finished that piece of second-hand sleuthing," Gus grumbled, "maybe I can get busy on that job of Mrs. Miller's. She won't admit it, of course, but she has run into something good and hard—probably into another car, while she was trying to park or unpark in a tight place. The Pitman

arm is bent so badly that her front wheels have a noticeable cut to them even when her steering wheel says that the car is going straight ahead. Naturally, she's been having a little trouble with her steering!"

"We don't get many steering-gear jobs any more, do we?" Joe observed. "I remember, when I was a kid, steering knuckles were always breaking, and putting people into the ditch or up a tree."

"Yes, I remember that, too," Gus agreed, getting down to business on the Miller car. "And I remember having a steering knuckle break. I wasn't going very fast, but I'll tell you that it wasn't a nice feeling. Well, they don't break nowadays. That's something that the automobile industry learned from racing—how to make steering knuckles that won't break."

"No, modern steering-gear parts seldom break, and the gears don't very often get very seriously out of adjustment. Once in a while, of course, you find a cracked bearing in a worm gear. That's because car owners—and some service-station men—sometimes forget that the moving parts of a steering gear, like any other moving parts of an automobile, need lubrication now and then. But usually a driver realizes that his steering gear needs lubrication before anything even that serious happens to it. When the gears in the steering-wheel column get dry there's a constant drag that even the most careless driver is likely to notice."

"When a fellow comes in here and says his car isn't steering right, I check up on a lot of other things before I start checking his steering gear."

"First of all, I take a good look at his tires. You'd be surprised how many drivers—even old-timers—think that their steering gears have gone wrong when the trouble is in their tires. One tire carrying twenty-eight pounds of air, while the other three are carrying thirty-two or thirty-five pounds, will set up a vibration that will make a car shimmy when it gets up to thirty-five or forty miles an hour. The car will keep pulling to one side, wander or weave, and steer as hard as the very devil going round a turn. Underinflated rear tires nearly always cause wandering."

"Then there are unbalanced front wheels. A two-ounce rubber patch on a vulcanized tread sometimes causes enough shimmy to bounce a wheel (Continued on page 246)

GUS SAYS:

You may be the best driver in the world, but it doesn't do you much good if your steering gear, brakes, and tires aren't in shape for any emergency. Never take your car out on the road unless you are sure you can control it instantly. It may make a lot of difference.

THE HOME WORKSHOP



This issue "DE LUXE" CABIN CRUISER COSTS LITTLE TO RUN •
BOBSLED, 1939 MODEL • BOOK-MATCH CONTEST WINNERS



Designed primarily for low-cost operation, the cruiser makes 6 m.p.h. with a $2\frac{1}{2}$ -h.p. motor



So light is the boat that it was carried from Florida to New York on this two-wheel trailer

Cruise All Day for a Dollar

IN THIS NEW 'DE LUXE'
SEVENTEEN-FOOTER

By WILLARD CRANDALL

from a design by

BRUCE N. CRANDALL



ECONOMY of operation, all-weather seaworthiness, and superior handling qualities are features of this new 17' *de luxe* cabin cruiser. It is especially designed for the newer small motors, with their low operating cost. Cruise all day for less than a dollar spent in gas; go, if you like, with this shallow-draft boat through many rivers and creeks and through water less than 1' deep where higher-powered cruisers could never navigate.

Special improvements have been developed to give this small cruiser a maximum speed with the low-power motors—6 m.p.h. with a 2½-h.p. motor and as high as 10 m.p.h. with the 10-h.p. models, or almost the same speed with which a similar motor would drive a rowboat.

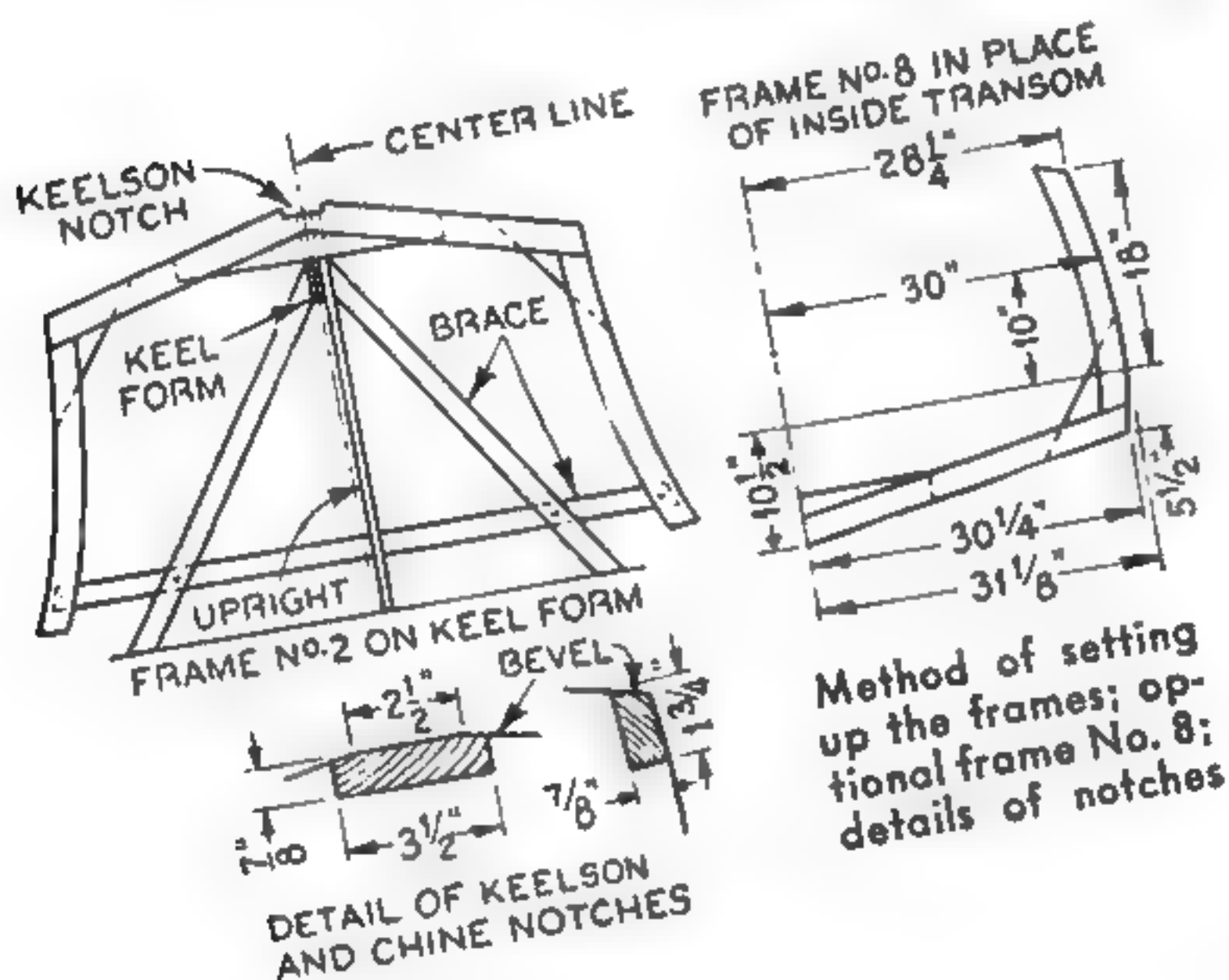
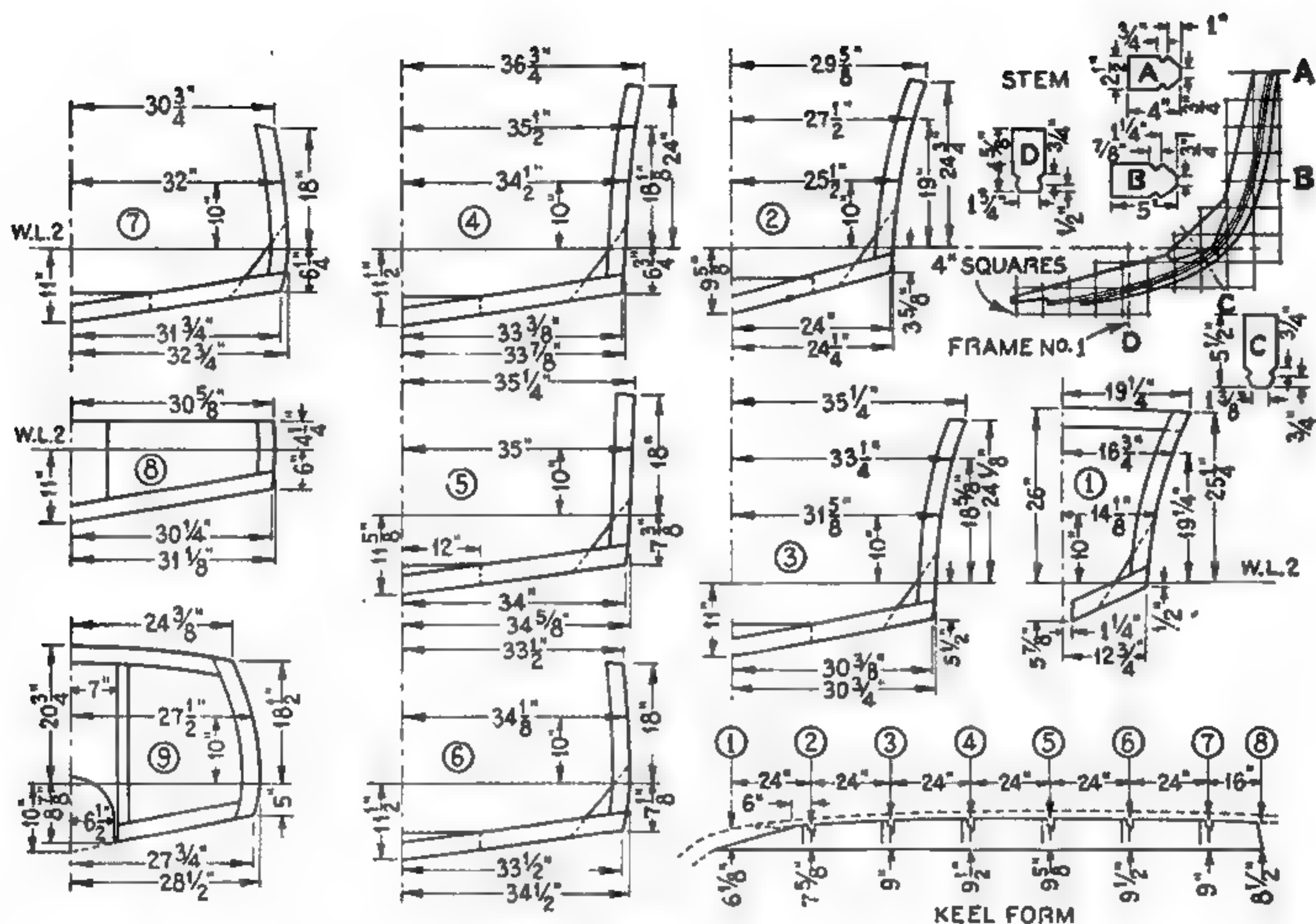
Such a degree of seaworthiness and stability has been incorporated in the boat that it is well adapted for fishing in any rough and unprotected waters—even for ocean use. For extended cruises it will accommodate two persons, or three if one sleeps in the cockpit. On short trips as many persons as can be crowded into it may be safely carried.

For ease of construction, this little cruiser compares more with an outboard runabout than with other cruisers. Total cost will range between \$75 and \$100 for the complete hull for outboard power, depending on the type of construction, the materials used, and local prices. The overall length is 17', beam 6' 2½".

The total weight, if batten-seam

**IT'S EASY TO BUILD . . SEAWORTHY . .
SMART LOOKING . . AND NEEDS ONLY A
SMALL OUTBOARD OR INBOARD MOTOR**





Dimensioned drawings of the frames with widths shown from the center line; a layout for the stem, and the form for the keel

be used in place of batten-seam; it will prove cheaper because of the saving in battens, fastenings, and marine glue. The list of materials given is for batten-seam construction and does not include equipment for inboard installation.

The design is well adapted for use with inboard marine motors from 2 to 10 h.p. Stern installation of an inboard motor is not recommended because of the cost of a good angle drive.

Headroom in the cabin is sufficient to allow a large adult to sit upright at any point. Under the cabin hatch it is 3' 9". Do not attempt to increase the headroom by raising the cabin as it will destroy the stability, as well as the appearance, of the entire craft. However, it is possible to increase the headroom slightly, if oak is used for the framework, by notching the cabin floor into the floor ties and frames and decreasing the depth of the cabin beams.

If desired, the entire boat may be drawn full size before starting construction, but it is not essential in this case because all that work has already been done; it is necessary only to draw full-size patterns of the frames, transom, and stem, or these may be purchased

construction is used, is between 700 and 800 lb., according to choice of materials. This is light enough for the boat to be taken anywhere on a two-wheel trailer. Draft without skeg is 8" or even less, depending on the weight carried. The skeg is optional; it will aid in steering when a strong wind is blowing and will protect the motor to some extent from logs and other underwater obstructions, but is a disadvantage in navigating shallow streams or in crossing sand bars or mud flats. A dinghy is not necessary as this cruiser can be beached almost anywhere a rowboat can.

Caulked construction, though heavier, may

already drawn. If an inboard motor is to be installed, however, it will be necessary to make a full-size side view, at least from frame No. 5 to the transom in order to determine the shaft angle, engine-bed angle, and other necessary measurements. As then there will be no inside transom, the keel form should be extended to the transom; the measurements can be taken from the full-size drawing.

For the drawing of each frame pattern, use a sheet of wrapping paper large enough for the assembled frame and folded in the middle in such a way that the fold will represent the center line. Draw water line No. 2 at right angles to the center line. Draw the side and bottom frames on one side, according to the measurements given in the drawings; and when one half is completed, punch through the paper at the important points, unfold it, and draw the other half. The curves are drawn by bending a light batten to the proper shape, holding it in place by small brads.

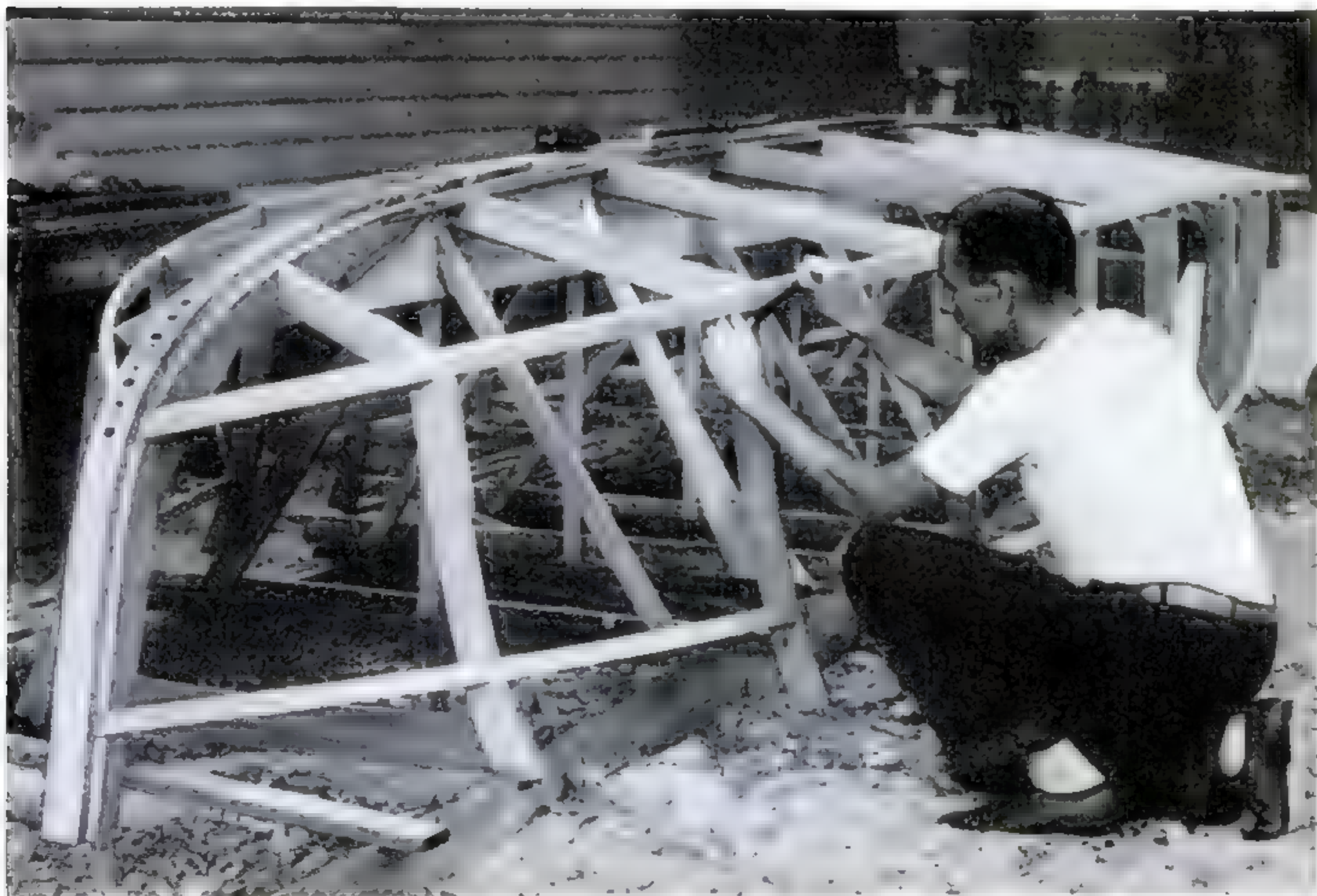
To lay out the curved frames from the patterns, place each pattern over the frame material and punch through with a marking wheel. The frames can then be sawn out and planed to shape. All bottom frames are made from straight $2\frac{1}{2}$ " pieces joined together with

floor ties, except for frame No. 1 and the transoms. The side and bottom frames do not lap, but are connected with large knees at the chine. The frames should be in position over the patterns while they are being fastened together. Either $1\frac{1}{2}$ " No. 10 flathead screws or 2" No. 10 machine screws may be used. These fastenings should be set in enough to allow for the chine, batten, and keelson notches and for the beveling of the forward frames. It will be well to paint the inside surfaces before fastening.

The transom planking should be screwed to the transom framework, and also to motor blocks on the inside transom, with $1\frac{1}{4}$ " No. 8 screws spaced about 3" apart, or with clinched nails or copper rivets. The surfaces to be joined should first be coated with marine glue or thick paint.

Nail temporary pieces across the top of all side frames and mark the center line on these pieces, on deck frames Nos. 1 and 9, and on all bottom frames except No. 1. Notches for the keelson should now be cut in the exact center of each bottom frame, including No. 8, but not in the transom planking.

Make the stem of three pieces from $2\frac{1}{2}$ " stock; then check it over the full-size pattern before bolting together, as shown in the



When assembled, all the frames and the chines are beveled so that the planking will fit the framework

drawings. Bolt the two parts of the stem to the knee with six 5" carriage bolts. A hole should be drilled and a stopwater (a soft wood plug) soaked with marine glue and driven in at the point at which the two parts of the stem join. The exact angles of the stem and rabbet can best be determined after the stem and frames are set up.

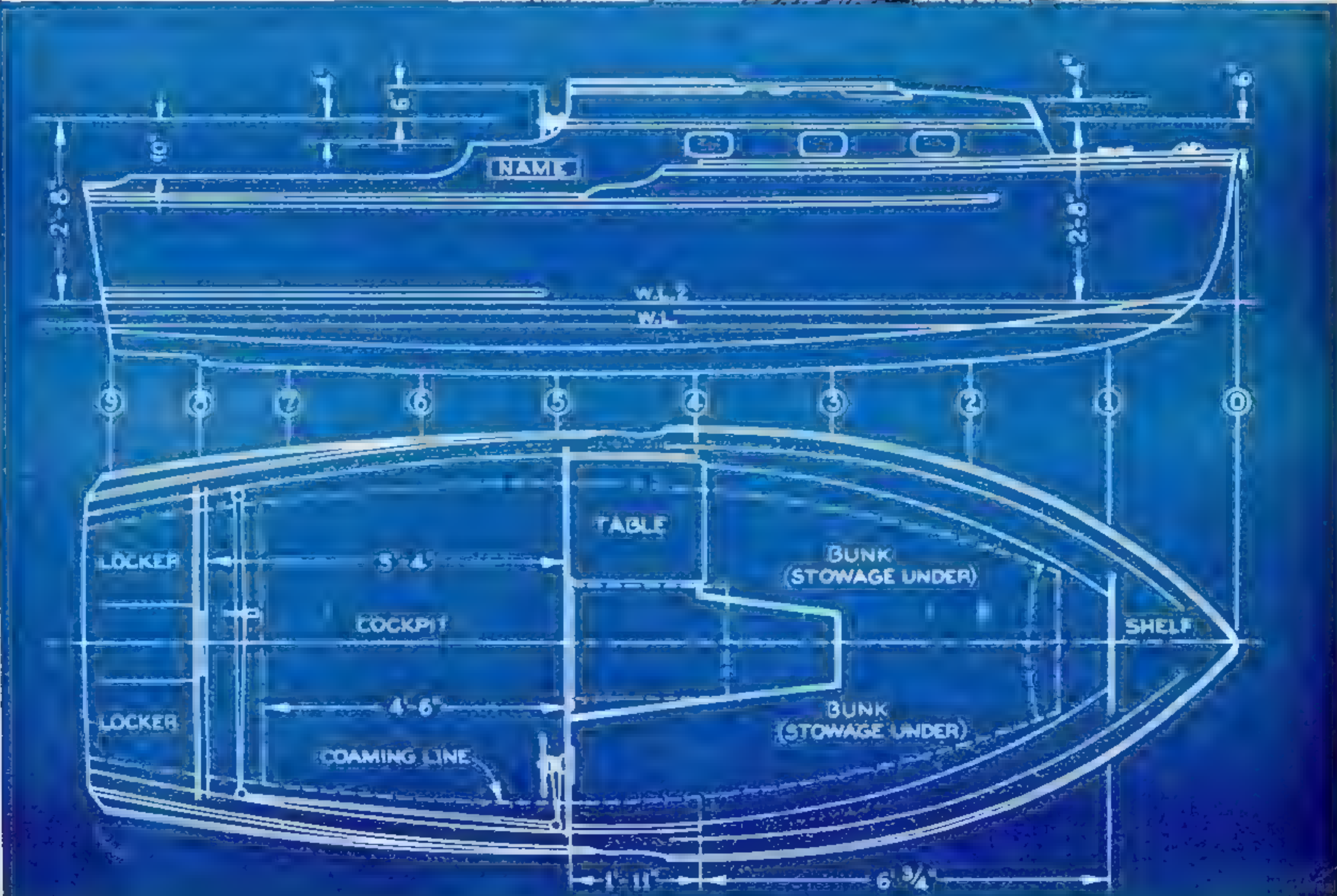
The hull can be built upside down on a framework supported from the floor or from two timbers; or the framework can be braced to stakes driven in the ground. The essential part of the framework is the keel form on which keelson, stem, frames, and inside transom will rest. Cut the keel form from a 1" by 10" by 14' plank according to the measurements given in the drawings. Cut notches where the frames and floor ties will rest; they should be just deep enough so that each keelson notch will be flush with the edge of the keel form. Nail uprights to the keel form at each station and set the form up at a convenient height for working, braced as shown. The uprights must be perfectly plumb and at right angles to the keel form. The frames should be set in the notches

and temporarily fastened to the uprights in such a way that their center lines are perfectly plumb and at the center of the keel form.

The keelson, stem, and inside transom may now be set up. The keelson should be fastened to the floor ties with 2½" No. 12 screws, two at each station, and to the inside transom frame (No. 8) and stem with 2" No. 12 screws. Clamp the keel temporarily in position



A light batten bent over the frames gives the angles for the stem rabbet



on the keelson in order to determine the extent of the bevel of the keelson. The keel and keelson should both be tapered where they join the stem. Screw the keel to the frames and stem with $2\frac{1}{2}$ " No. 12 screws, and to the keelson with $1\frac{1}{2}$ " No. 8 screws spaced about 8" apart. Before the keel is fastened, the joining surfaces should be coated with marine glue or paint. If the boat is built outdoors, all parts should be painted as the work progresses.

After making sure that the stem is in perfect alignment and that each frame is at right angles to the keel form, the notches for the chines can be cut in all the frames. The chine will run past the inside transom and notch into the transom frame, No. 9. Clamp a batten in place before cutting the chine notches to make sure of getting a true curve and the proper bevels. Cut the chine pieces down to about $\frac{1}{2}$ " where they are to be notched into the stem. The rabbet may now be cut in the stem to the thickness of the planking with the aid of a light batten. The chines can be fastened to the frames and chine knees with 2" No. 12 screws and to the stem with $2\frac{1}{2}$ " No. 12 and $1\frac{3}{4}$ " No. 10.



IDEAL FOR SHALLOW AND UNCHARTED WATERS

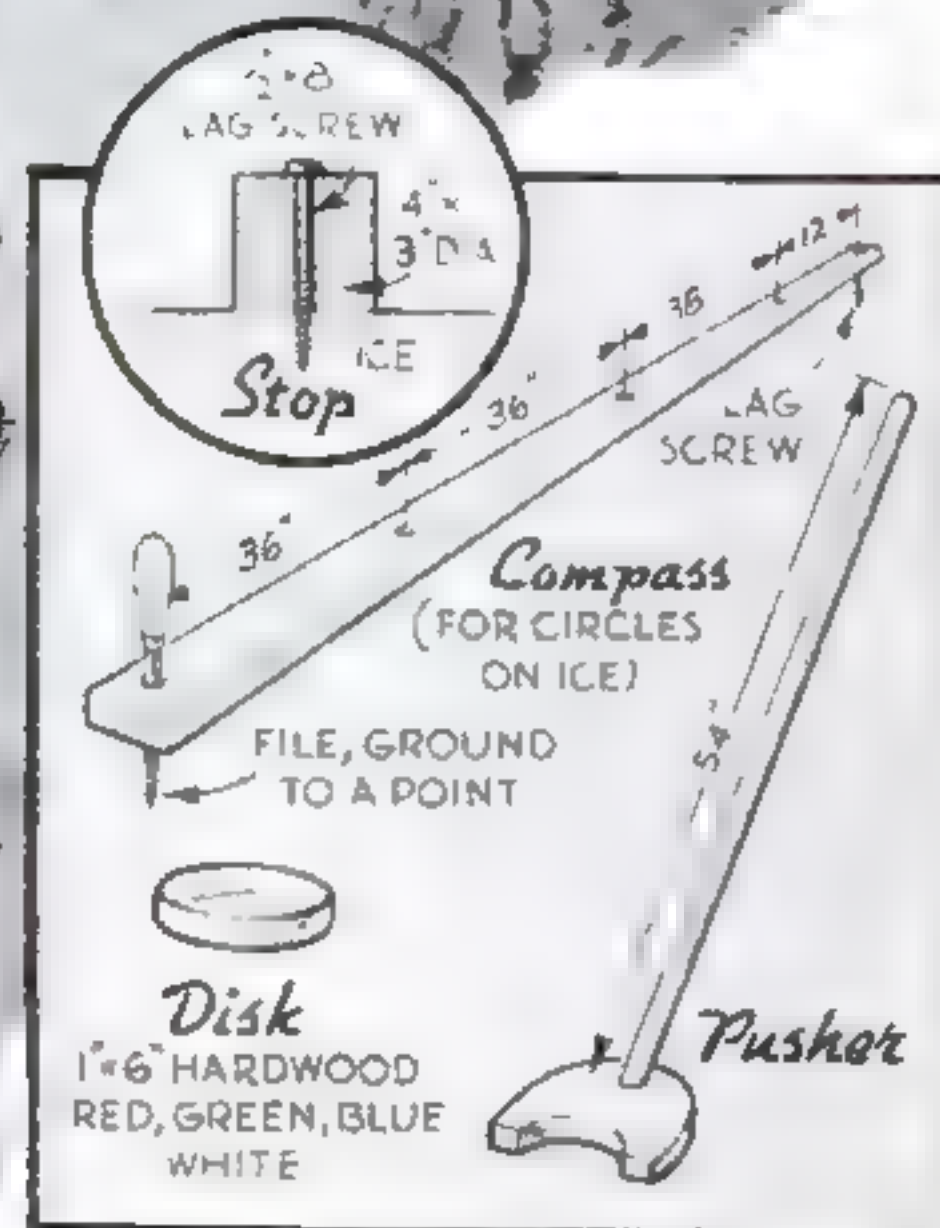
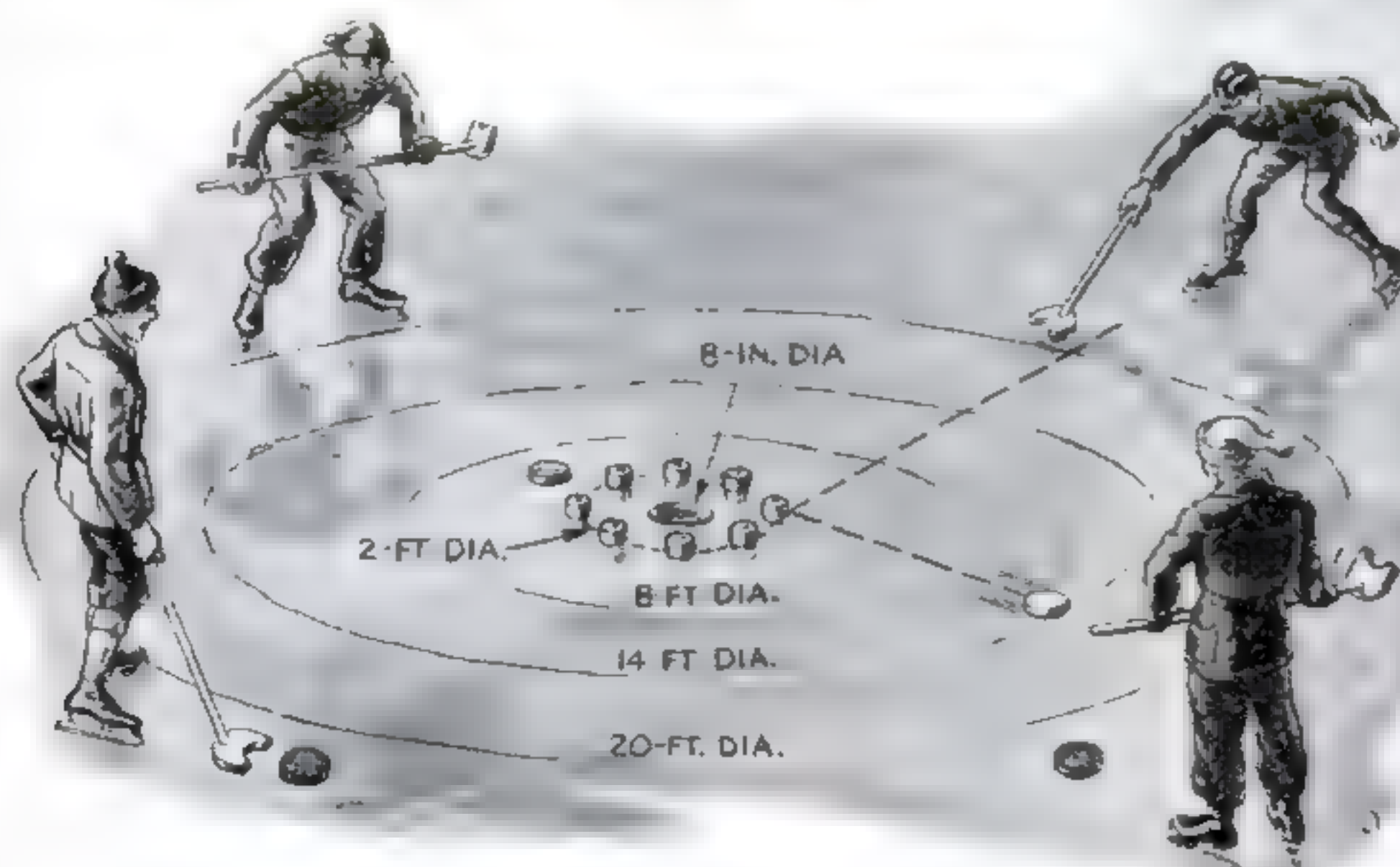
Because of its shallow draft, the cruiser is well adapted for navigating rivers and creeks. It can be beached like a rowboat and needs no dinghy. Most of the pictures in this and following installments were taken in Florida, but the color photos on pages 159 and 160 are the expert work of its present owner, Harold Shermer, of Union Hill, N. Y.

Notch the sheer battens into the frames and fasten with $\frac{1}{2}$ " No. 8 screws. The outside transom may be set up in place, 16" from the inside transom, and fastened to the chines and sheer battens. Then the sides of the motor well can be fastened. All joints must be made water-tight by using cotton flannel-ette soaked in marine glue.

(TO BE CONTINUED)

Crokinole Game Laid Out on Ice for Skaters

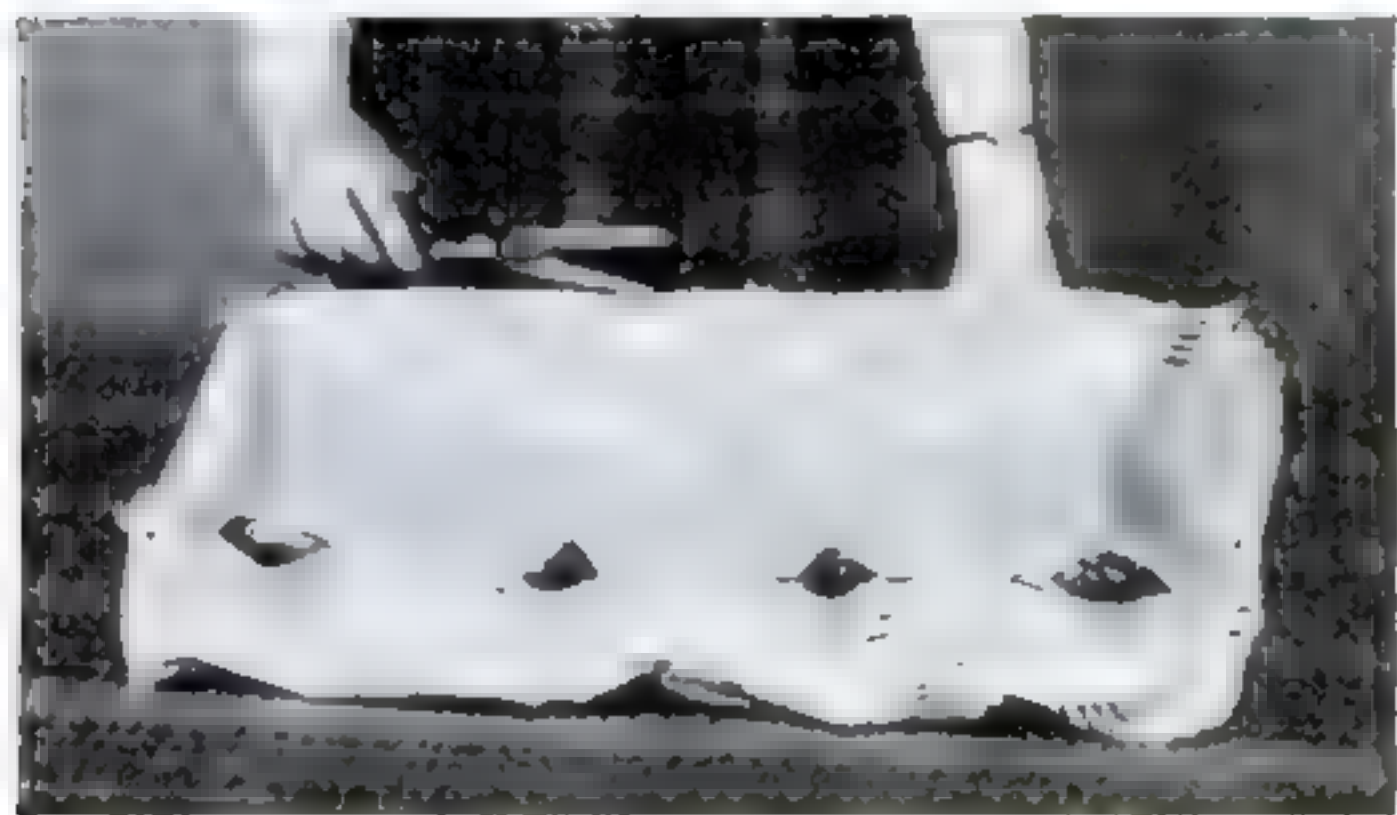
"ESKIMO CROKINOLE" is the name given this game for skaters. The "board" is laid out upon smooth ice as shown and played to conform to standard rules. The eight wooden stops are fastened with lag screws, but holes should first be bored in the ice with a bit.



WHAT TO DO

When Cushions Shed Feathers

Right, using vacuum cleaner to remove down and feathers from an old pillow. Below, rubbing beeswax on a casing



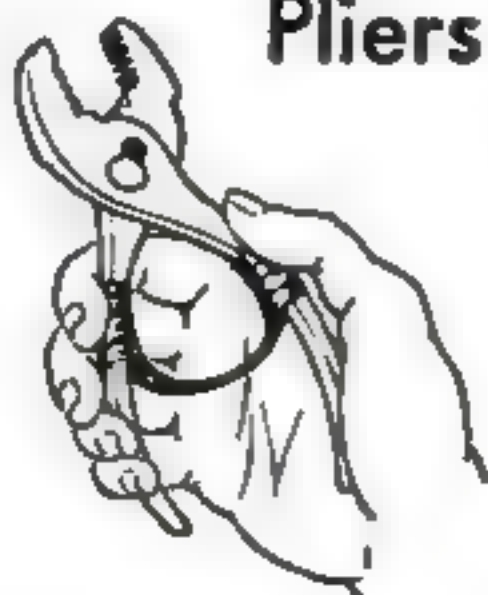
A cushion casing sewed up and ready for filling

WHEN down and feathers sift through the covering of pillows or cushions, they should be refilled or re-covered.

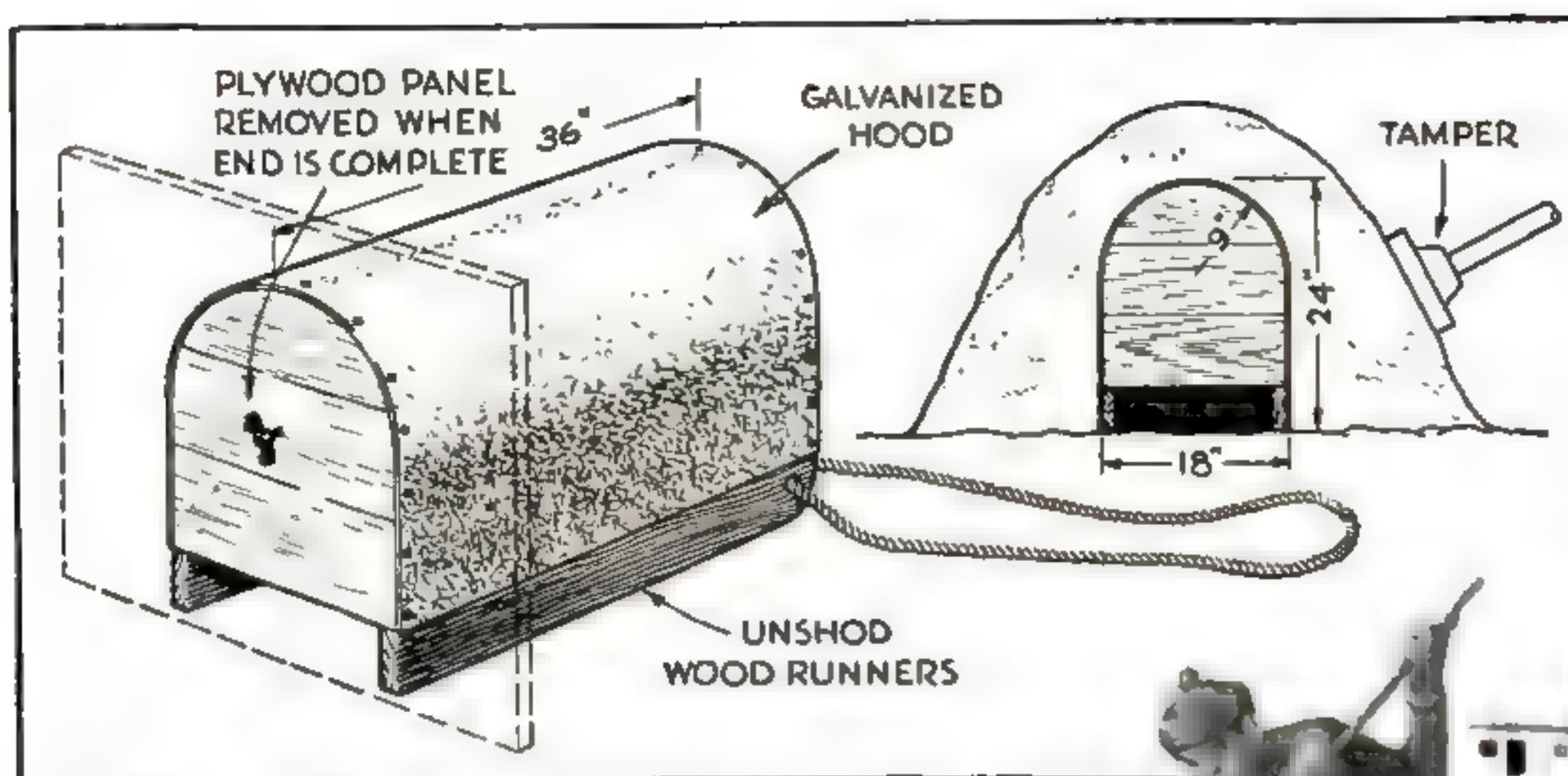
Refilling. Remove down and feathers with vacuum cleaner after replacing cleaner bag with a temporary cloth bag. Rewax casing by rubbing inside with cold beeswax. If casing is divided into sections, be sure proper amount of feathers and down is put back into each. On chair or davenport cushions, a more comfortable seat will result if the front section contains a little more filling than the center and rear sections. A family scale will aid. First weigh the casing, fill front section to the desired firmness, and weigh again. The difference is the amount of filling used. Repeat until all sections are filled.

New casings. Purchase ticking of desired design, and necessary feathers and down. The more down used, the better the filling. For pillows, the new casings are merely sewn up except for an opening for filling. For cushions, the casings should have walls or sections sewed through 6" or 8" apart as shown above. Cut top and bottom of a cushion casing 1" larger than the outside covering, and cut walls 1" wider than its height. After the sections have been marked on inner side of top and bottom, sew the border and walls to the bottom. Next the walls are sewed to casing top, beginning with center wall and continuing towards the end. The border is now joined on the outside of the casing top, leaving an opening at each section for filling with feathers and down.—HERBERT BAST.

Pliers Fitted with Spring



FOR turning a bolt or nut in a tight place and similar awkward work when it is difficult to shift the pliers, it pays to fasten a piece of clock spring to them.—F.K.



The form for the tunnel consists of a wooden frame covered with galvanized iron, and a detachable end

Damp snow is packed over the form with a tamper. Then the end wall is removed so the form can be used again



Boys Build Long Snow Tunnels Over a Movable Form

DEEP snow is always an invitation to children to build tunnels. A quick way to make tunnels or "bombproof" shelters is to build a form with a detachable end wall, as shown above. Pack damp snow over this with a

tamper, then remove the end wall by means of the thumb nut, pull the form ahead about two feet, and proceed as before. In this way you can make a tunnel as long as the supply of snow permits.—D.H.

BLEACHING WOOD

[PAINTING]

1. Sand the wood clean and smooth.
2. Make a saturated solution of oxalic-acid crystals by adding one cupful to two quarts of hot water.
3. Apply with any brush that does not have a tin or iron ferrule. A brass-bound rubbing brush, for example, is suitable.
4. Let the surface become almost dry, then wet it again with the bleach if necessary.
5. Neutralize with a saturated solution of borax (*not* boric acid) by adding one cup to one quart of hot water.
6. Dry, sand clean, dust carefully, and proceed with the finishing schedule in the usual way.

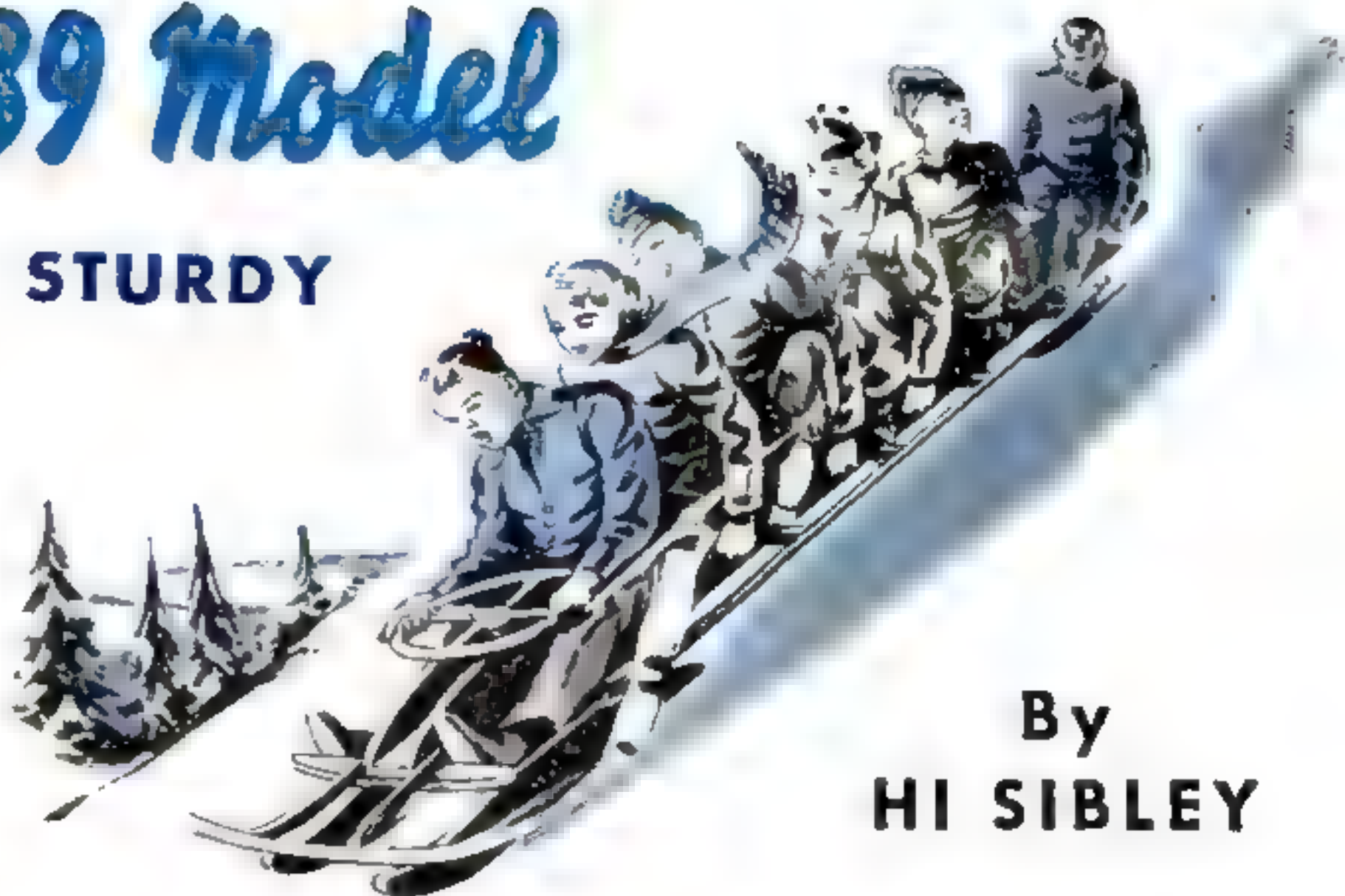
NOTE: Label the oxalic-acid solution *POISON*.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Bobsled, 1939 Model

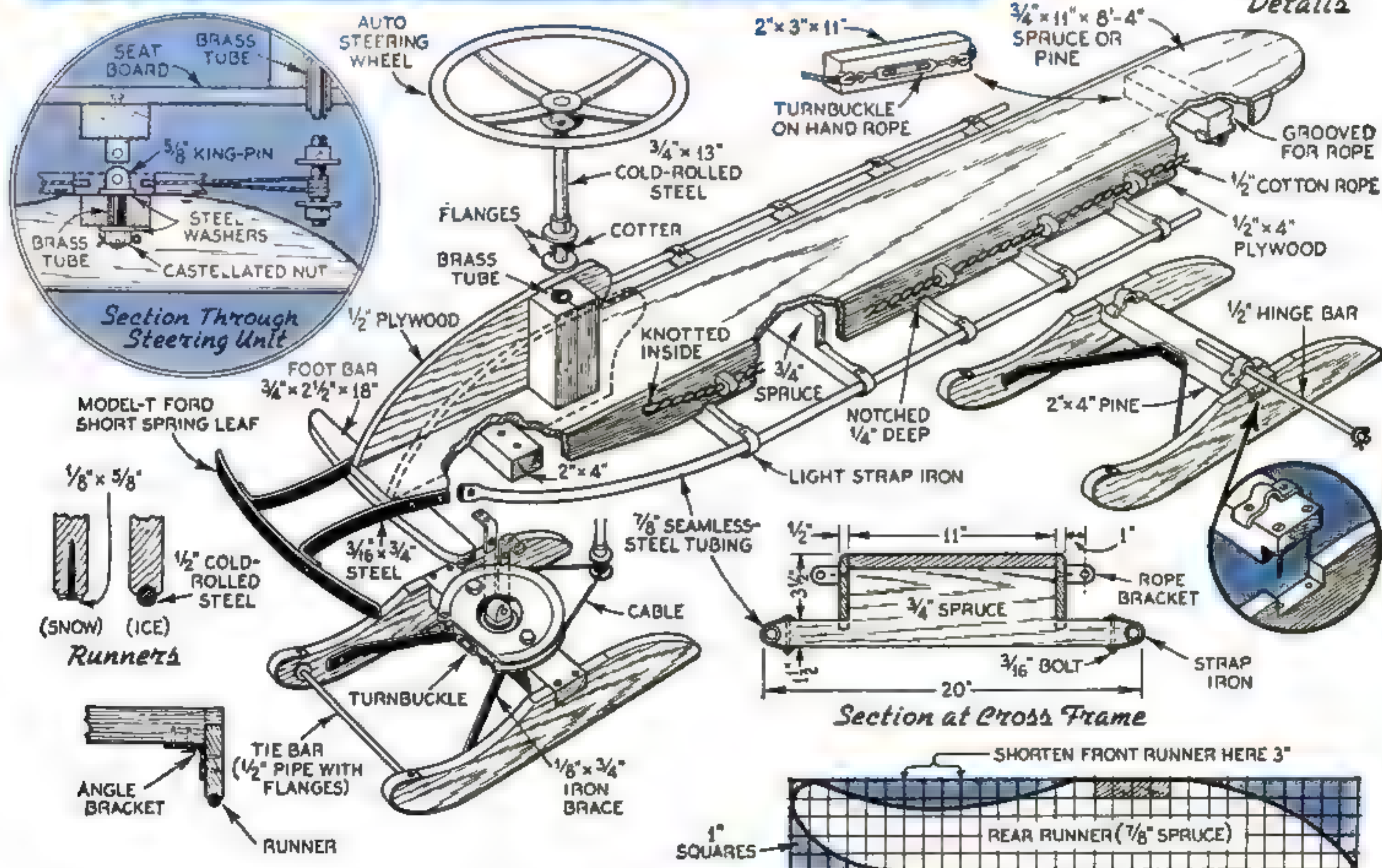
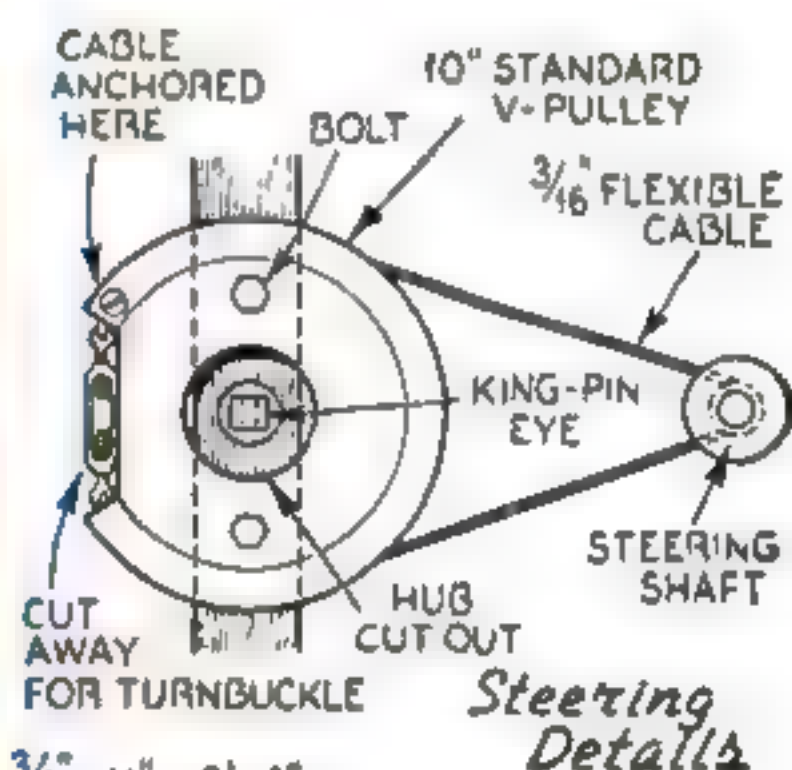
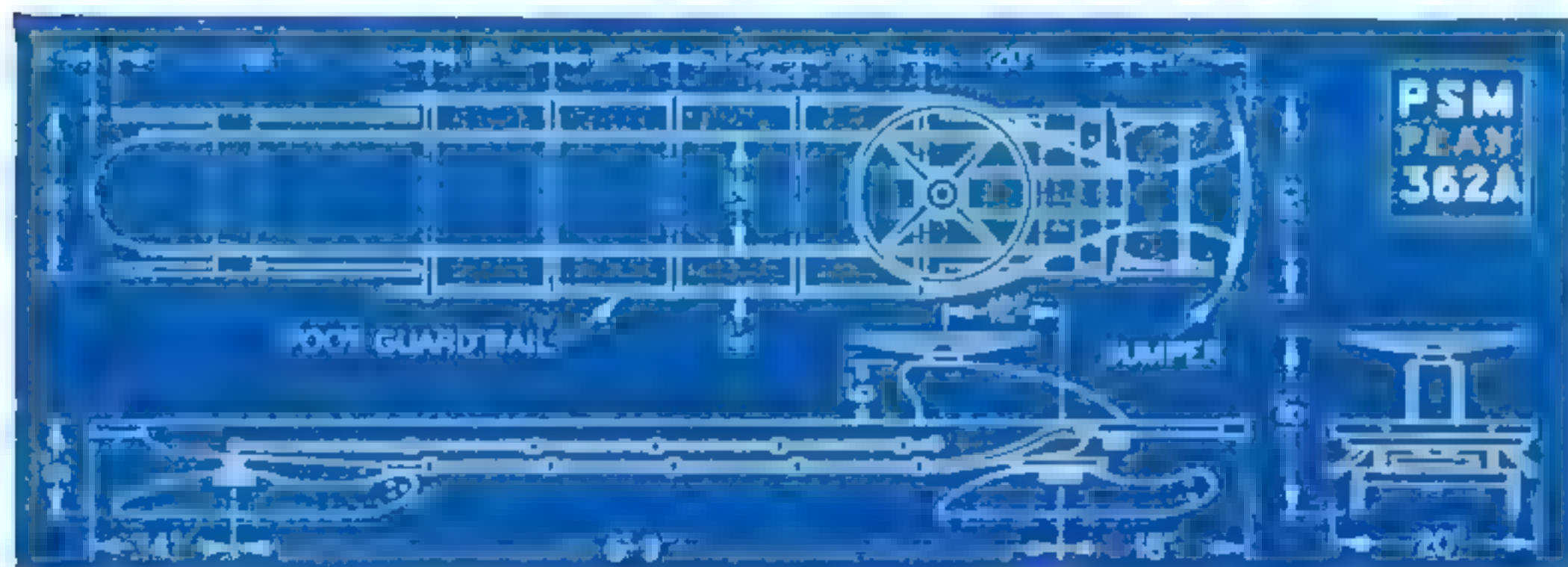
...LIGHT, SAFE, STURDY

A BOX-FORM chassis of spruce and plywood, combined with thoroughly braced runners, makes this bobsled exceptionally light without sacrifice of strength. Foot rests are protected by a seamless steel tubing guard rail, and a spring bumper in front reduces collision hazards. The bumper could, of course, be omitted if suitable material is not at hand. Particular attention has been given to the design of the nonslack steering gear, which permits complete free-

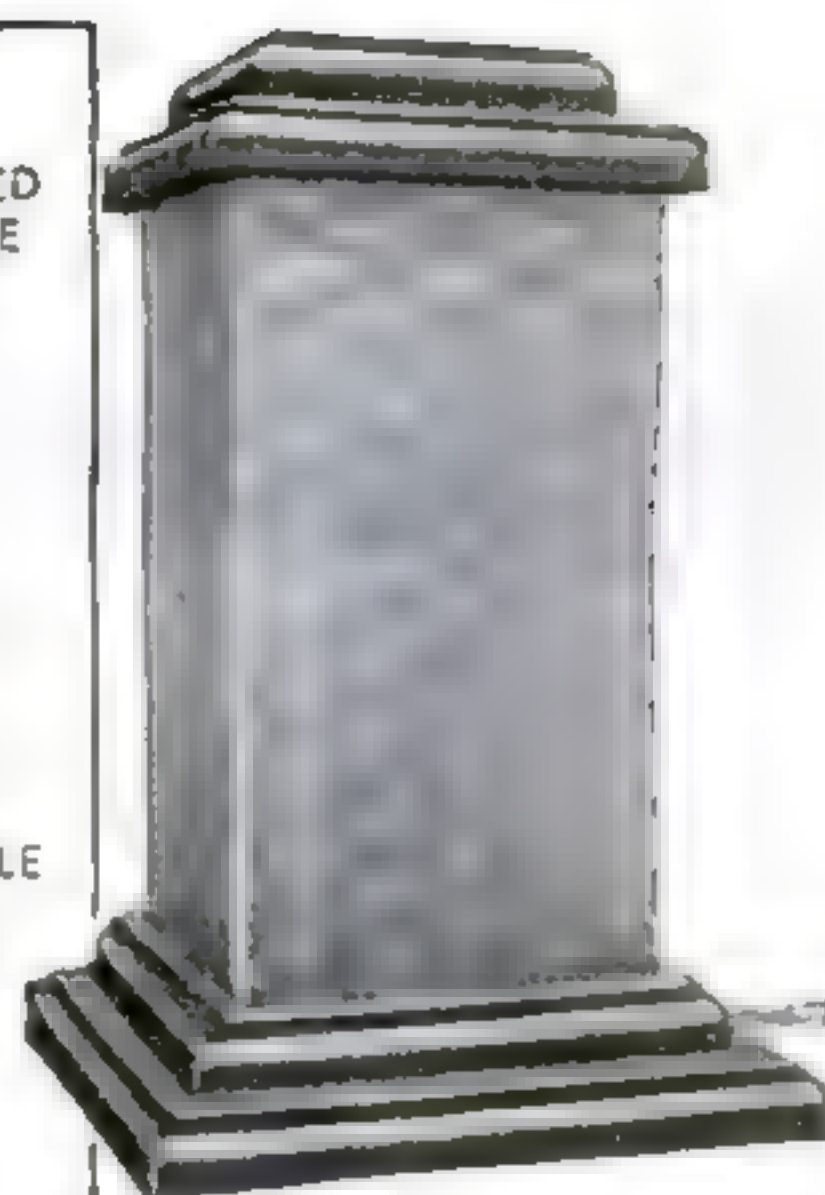
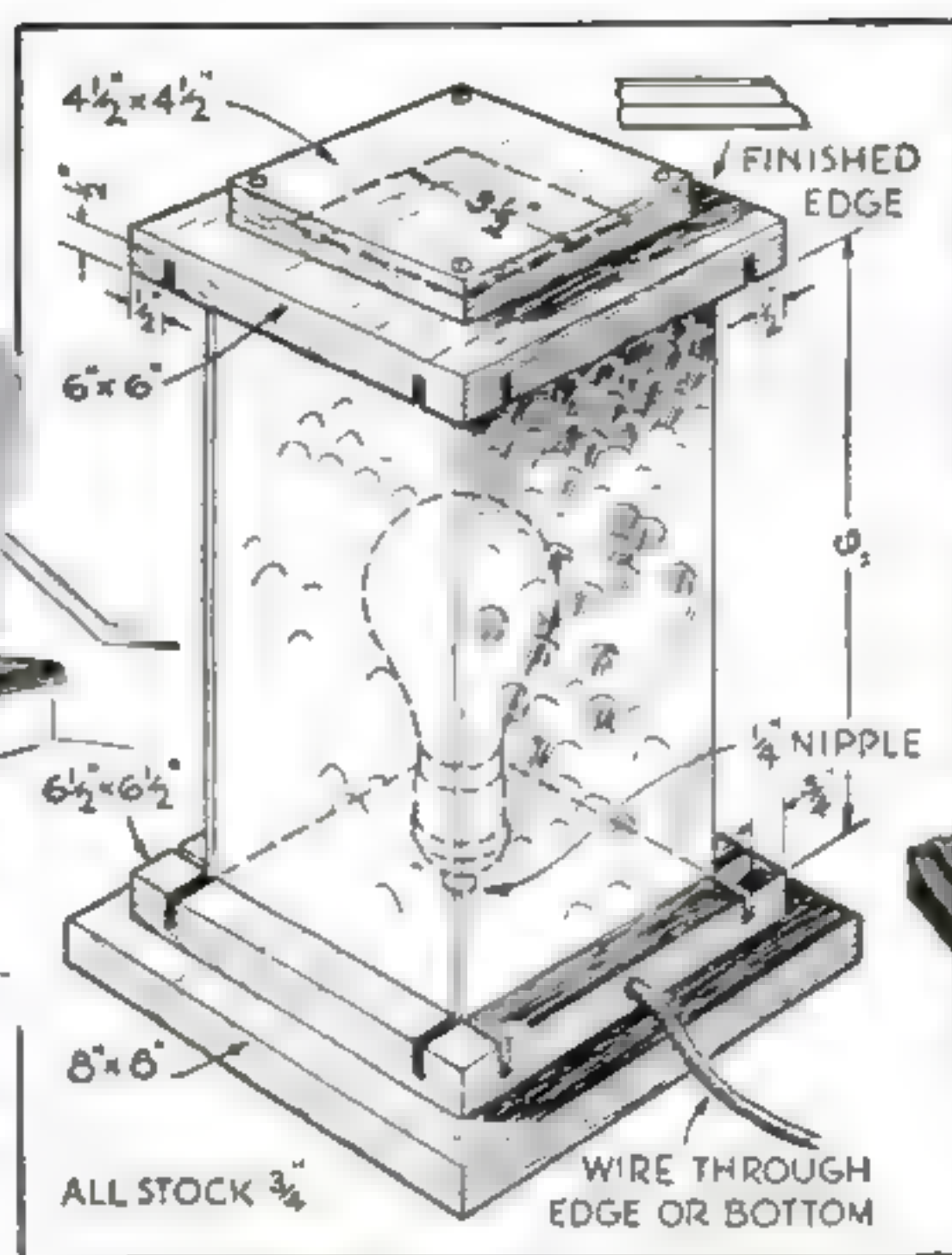
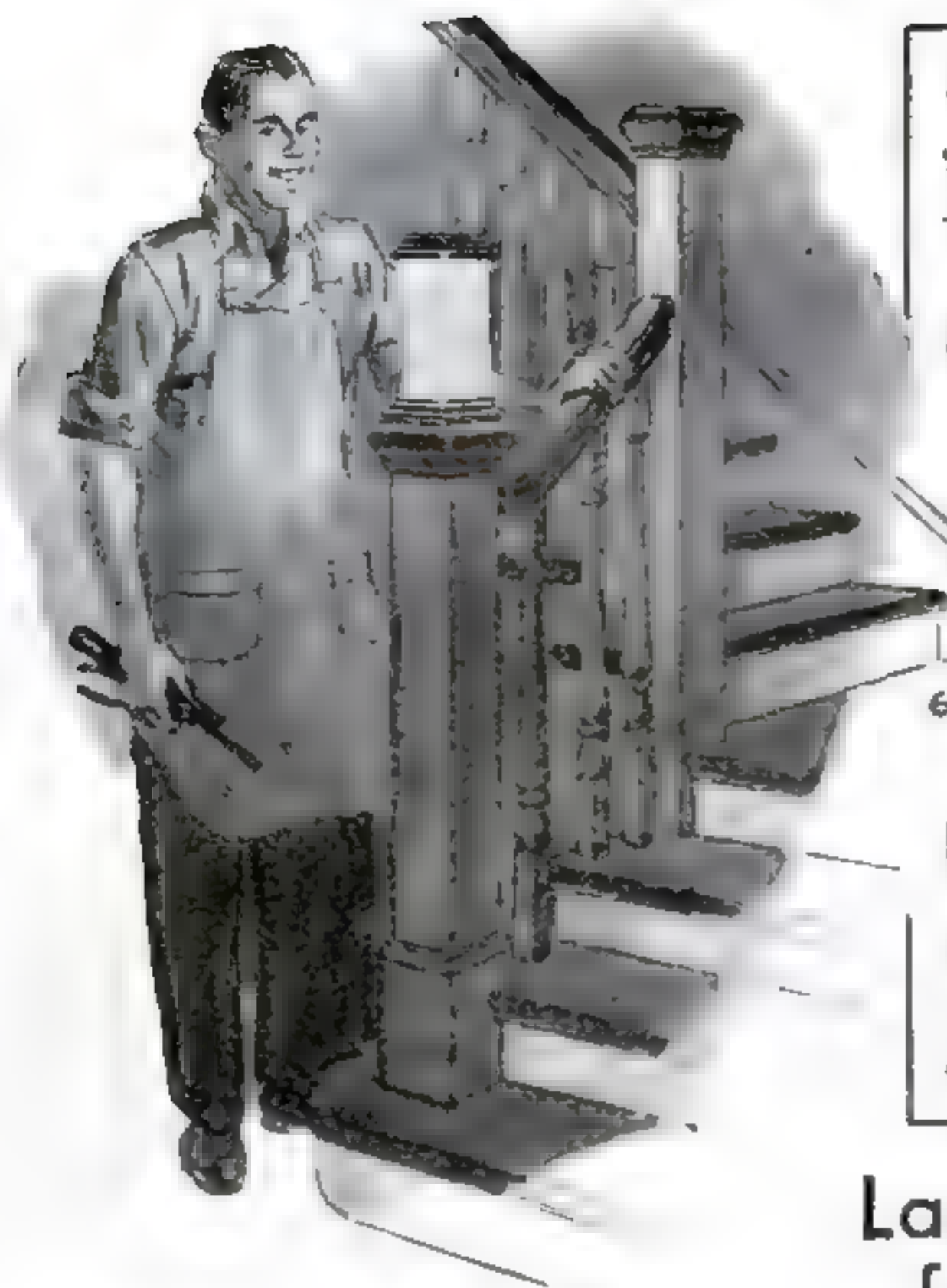


By
HI SIBLEY

dom of movement with cables always taut. For fewer than six passengers, decrease the length of sled by 1' for each person less.



How the bobsled is built. The guard-rail tubing is heated before being curved in and up on each side



A completed lamp. The glass is fastened into the saw kerfs with glue

Lamp for Newel Post Constructed from Wood and Frosted Glass

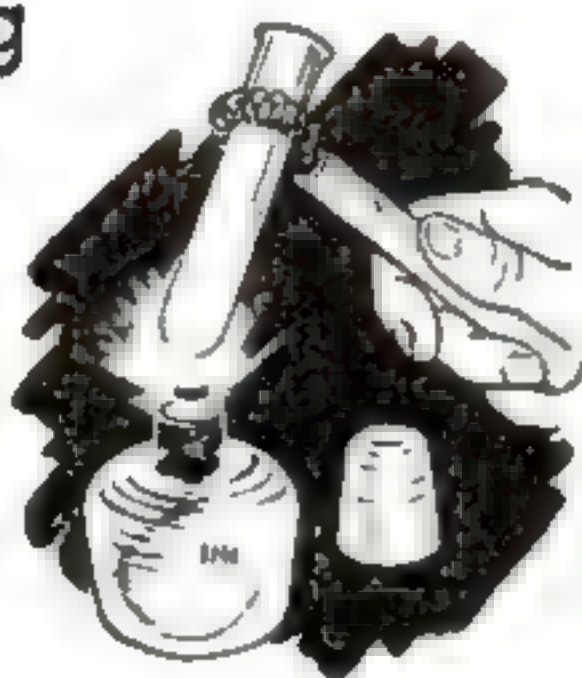
THIS decorative lamp for use on a pedestal or column can be made very easily by the method illustrated. It may be used, for example, on a newel post or, if provided with approved weatherproof wiring, for illuminating a walk or drive.

For a lamp of the size shown, two pieces of glass 5" by 10" and two 4 7/8" by 10" are required. These should either be frosted or impressed with a design or, if only plain

glass is available, they may be frosted by rubbing with abrasive powder and water applied by means of another smaller piece of glass. The glass is fastened into the saw kerfs with cement, waterproof glue, or white lead, and the ends of the kerfs are inlaid with wood or filled with a plastic composition. To insert a new bulb, the top piece of wood is unscrewed. The second piece has a 3 1/2" square hole cut in it.—R.H.J.

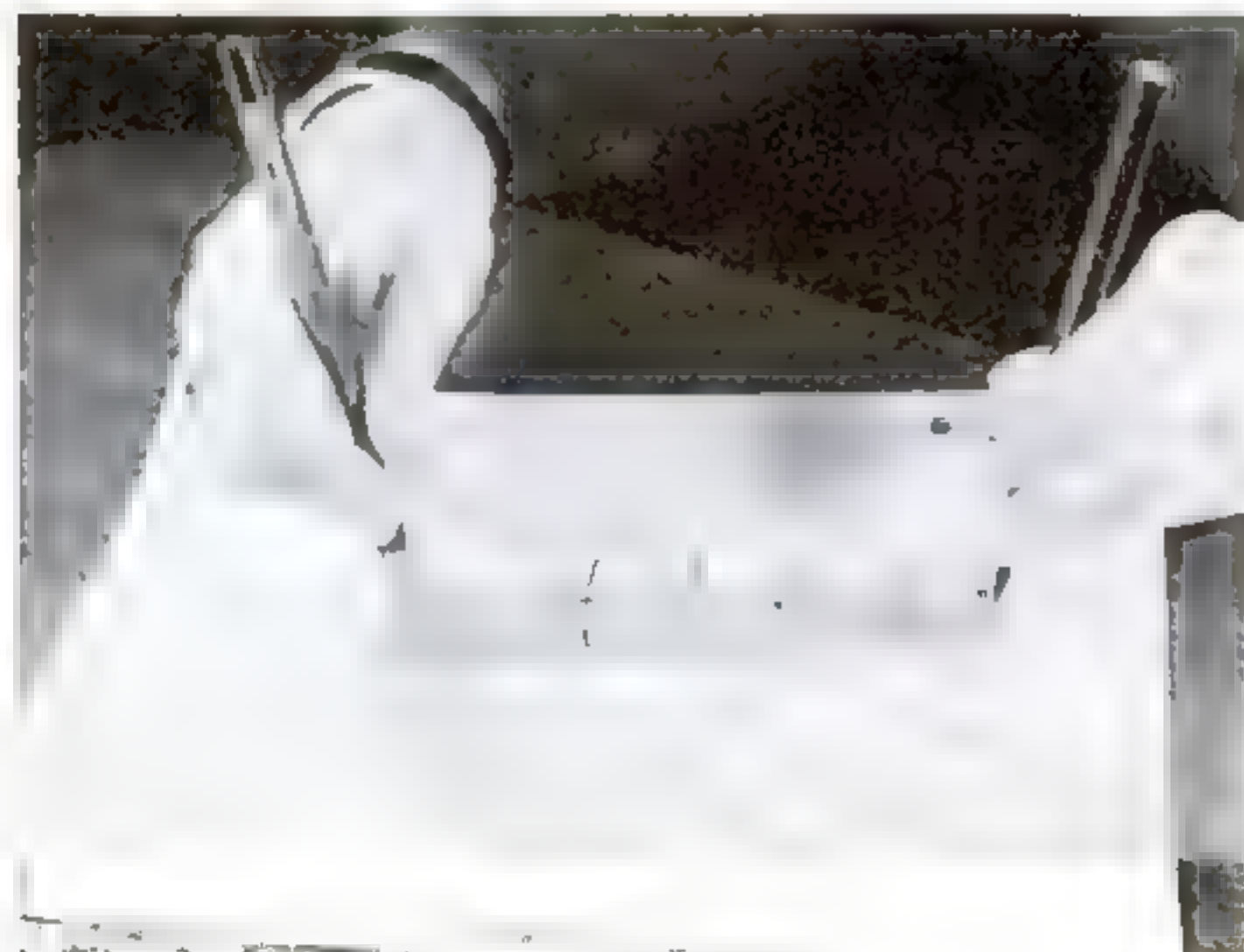
Looped Coil Spring Holds Test Tube

A CONVENIENT holder for heating test tubes may be made by looping a 1/4" coil spring and thrusting the ends into a short length of rubber tubing, as illustrated at right. Several holders with various size loops may be made, if necessary, to accommodate different test tubes.



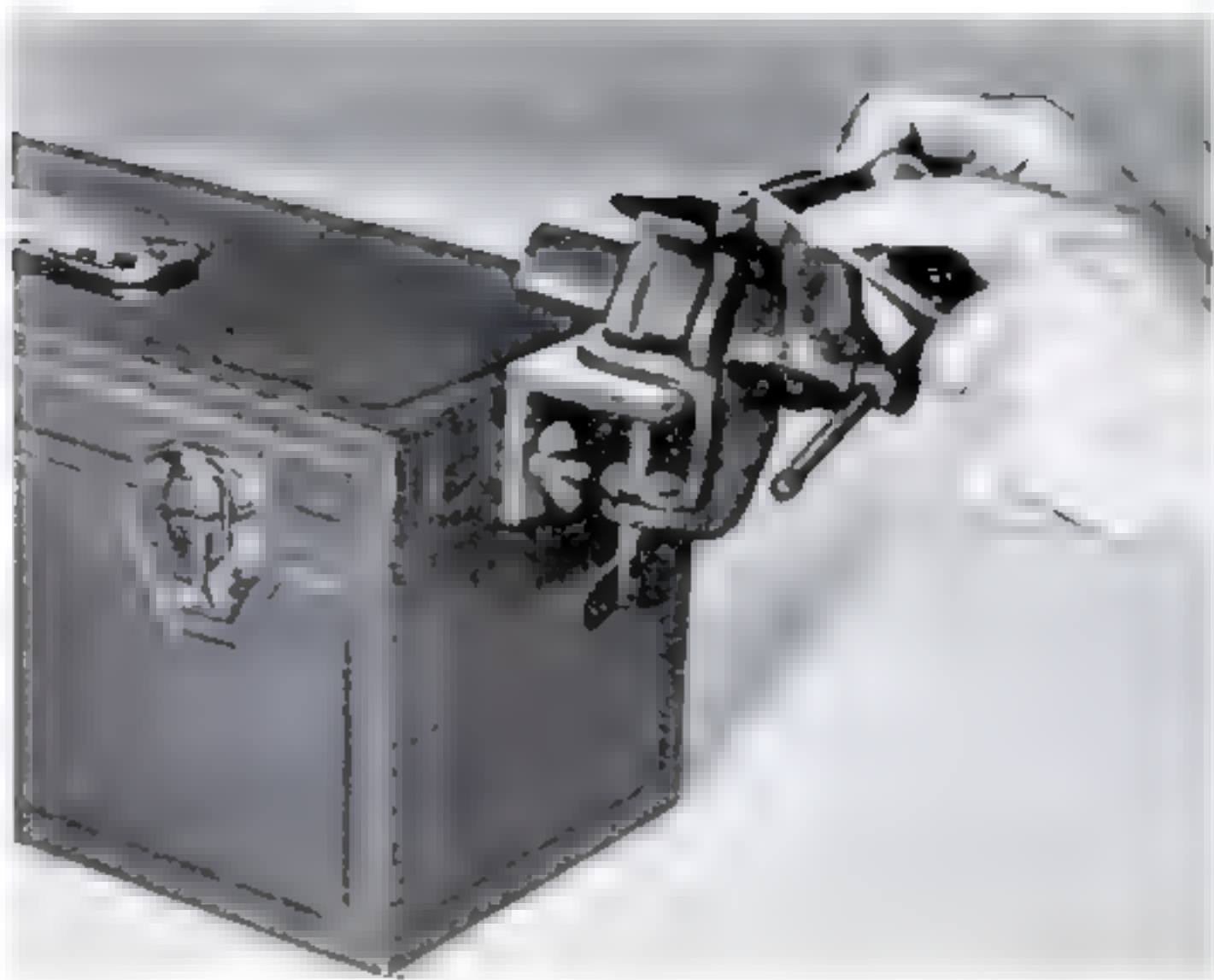
Small Rule Serves as Compass

IF AN ordinary 6" pocket rule is drilled with 3/64" holes along its center as shown, it will serve as a compass for school work and for shop drawings that do not require more than approximate accuracy. The holes are made 1/8" apart for the first inch, and 1" apart thereafter.—S.R.B.



Wooden Disk Insulates Valve

BURNED fingers sometimes result from the use of iron or steel valve wheels in places where they are exposed to heat, as on blow-torches or steam lines. This can be corrected by sawing or turning a wooden disk somewhat larger than the valve wheel and attaching it with several small bolts. Round the edges with sandpaper.—ALLEN ZERBE.



Vise Clamps to Tool Box for Small Repairs

FOR repair work and odd jobs away from the bench, a small vise may be attached to a tool box by the method illustrated above. A small bracket is cut from a piece of angle iron and drilled so that it may be fastened to the lid of the chest with two bolts and wing nuts. The vise is then clamped to the projecting leg of the ell.

This simple device occupies but very little space in the tool box and is easily assembled so that keys and other small metal parts can be shaped with a file.

Strap Iron Gives Support to Pail



A FEED pail may be held on the arm with less effort if a holder is made as shown above from a piece of strap iron. Two loops are bent, one to fit the arm and the other to suit the pail, and both are then riveted securely in place.—NORVAL WRIGHT.

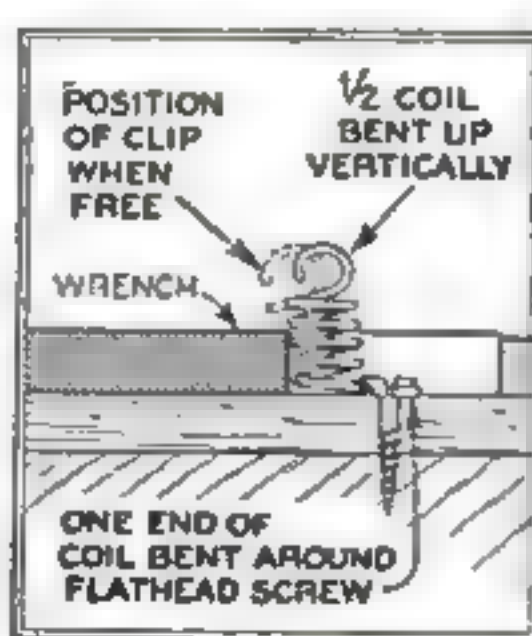
Spring Clips Hold Wrenches in a Tool Panel

WRENCHES are held in this tool panel by clips made from a close-coiled tension spring such as sometimes used for closing screen doors. Cut off several coils and bend one complete end coil over so that a flathead wood screw may be inserted through it for fastening the clip to the board. At the other end, bend up half a coil at right angles as sketched.

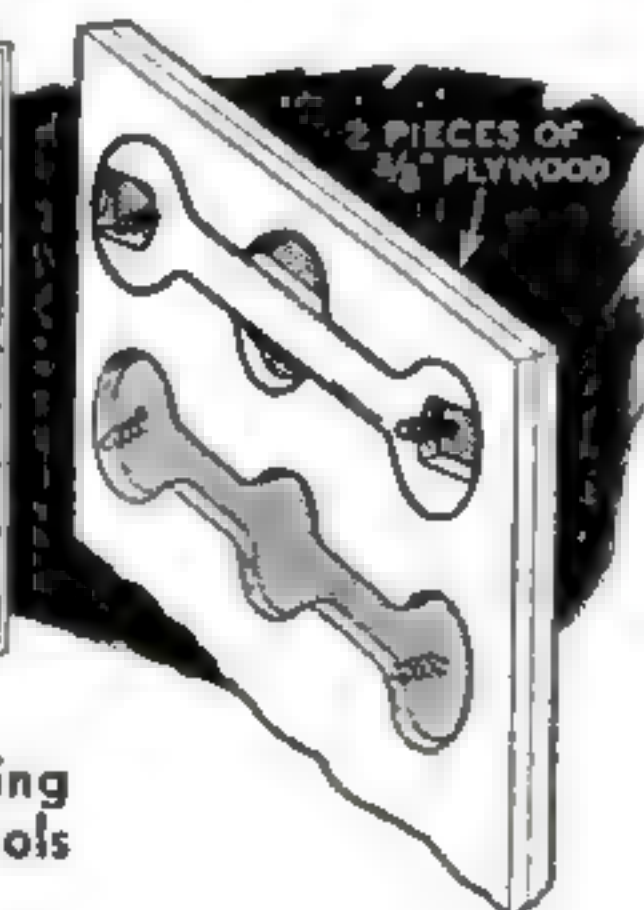
Mount a clip thus made in the notch at each end of the opening so that they will be spread apart when the wrench is pushed into place. The sharp corner of the wrench will then catch below one of the spring coils and be held firmly enough for ordinary purposes.

If mounted on a cabinet door as at the right, the panel is made of two thicknesses of $\frac{3}{8}$ " plywood. The outer piece is jig-sawed on the outline of each wrench, and an ample finger hole is provided at the center of each shank for removal.

—DONALD A. PRICE.



Method of mounting clips to grip tools

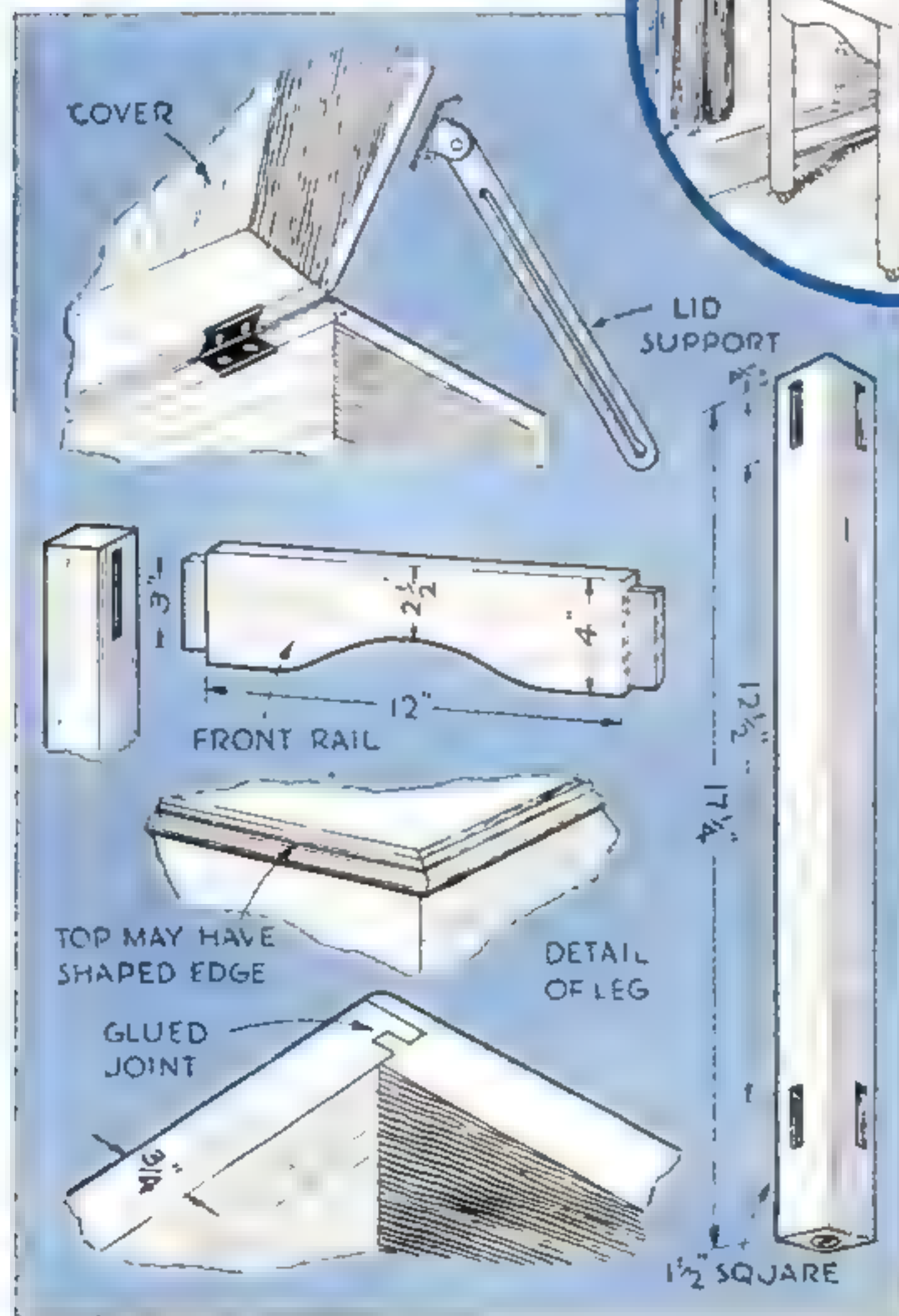


Panel fastened on door of cabinet. The outer piece of plywood is jig-sawed on the outline of each wrench

Businesslike



Filing cabinet in use alongside one of the desks mentioned on the facing page. The cabinet, when closed, forms a small table



A FILING CASE

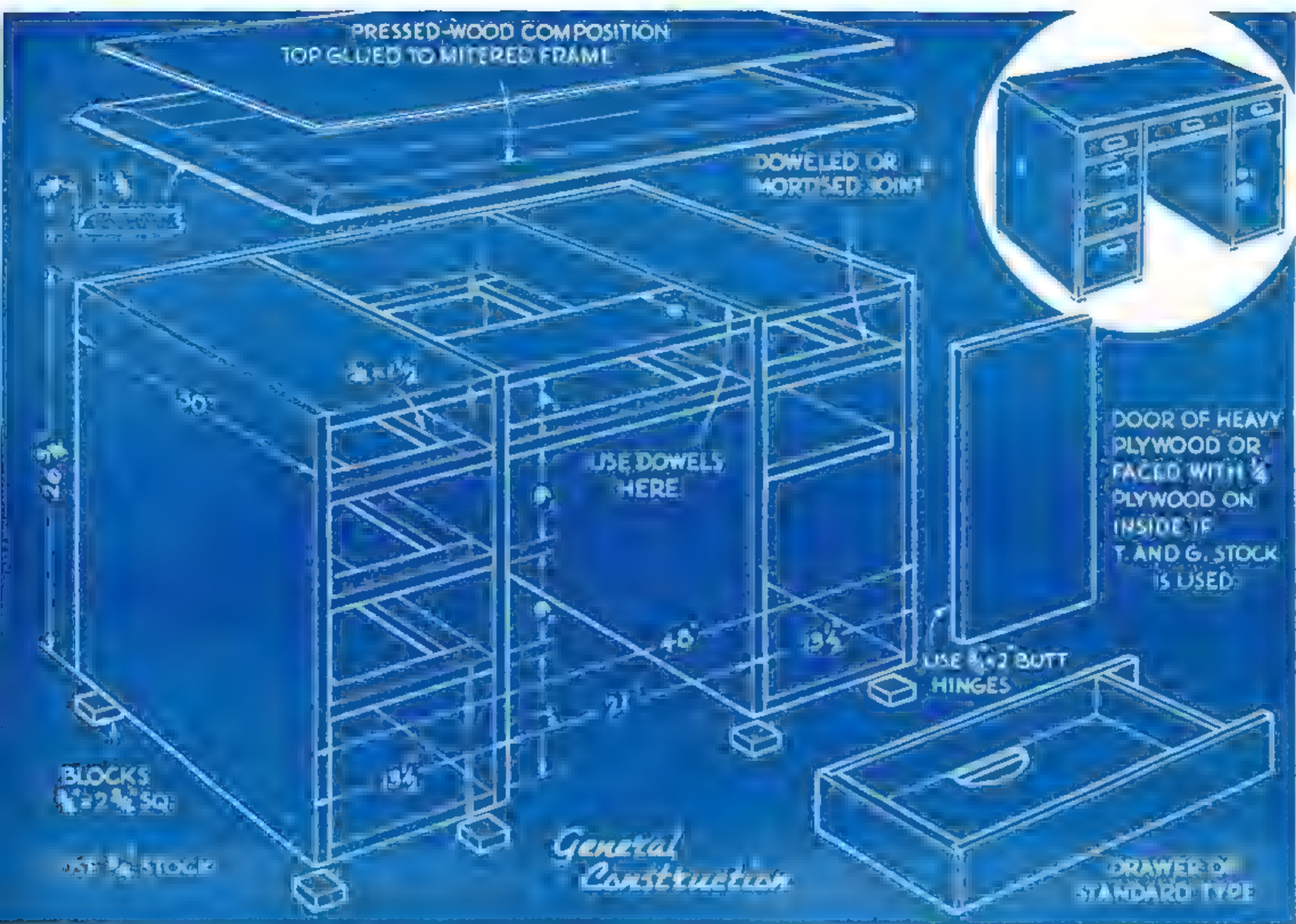
By J. I. Sowers, director of industrial education, Miami, Fla.

EVERY home needs a filing case, and this design has the advantages of being presentable in appearance as well as compact and convenient. The case takes standard file folders obtainable at any stationary store. Headings such as "insurance," "bills," "taxes," "road maps," and "correspondence" may be written on the index tabs.

When not in use for filing, the cabinet will double as a small table, and the original has proved useful as a bedside table in illness. It is the standard table height of 30", so that it may be drawn alongside any table or desk for working with the filed materials.

The case may be made of oak, red gum, or any wood to match the furniture or trim of the room in which it is to be placed. If it is to be enameled, white pine or other close-grained softwood may be used.

Furniture for the Home

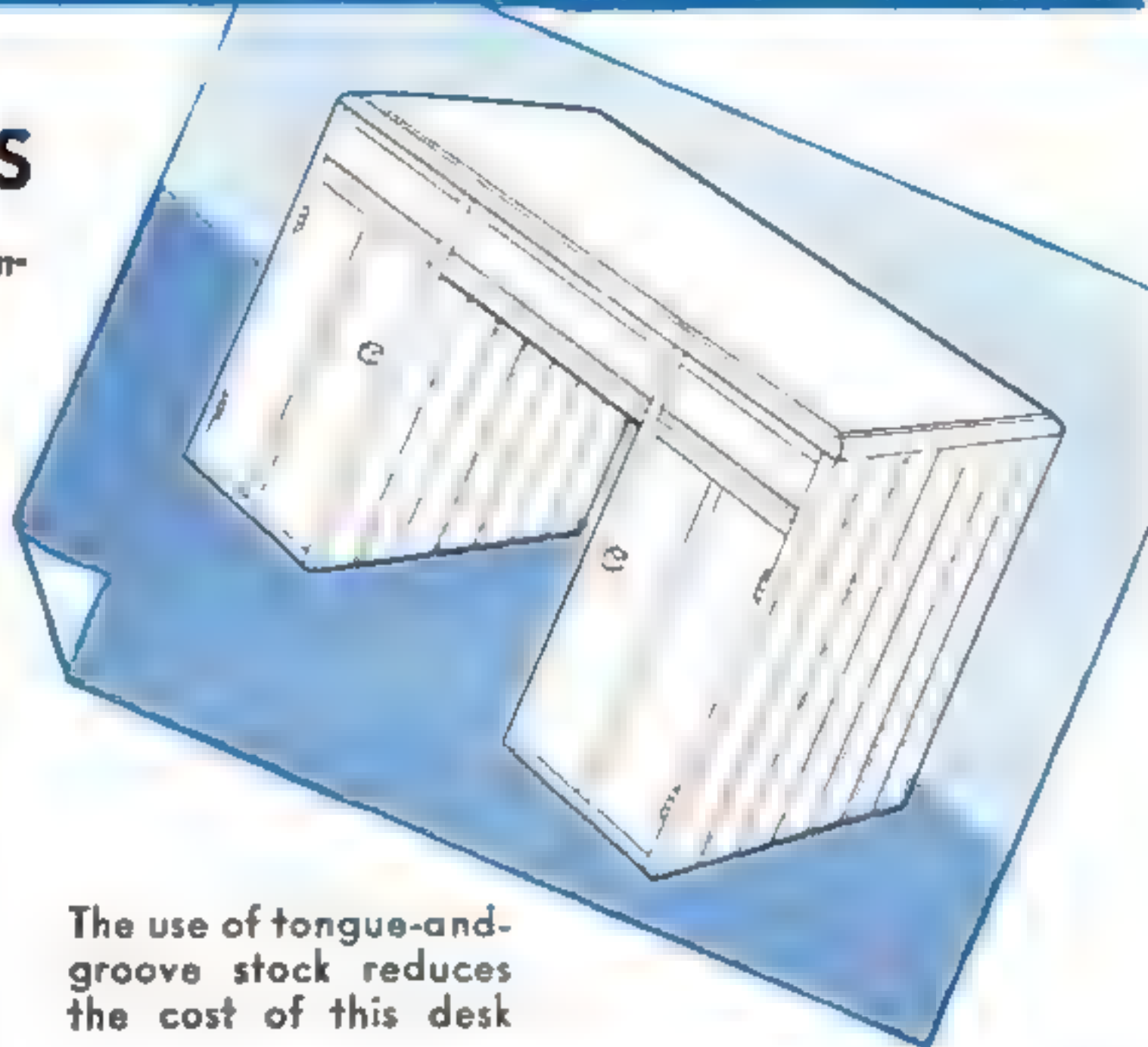


MODERNISTIC DESKS

By R. H. Jenkins, professor of industrial education, Humboldt State College, Arcata, Calif.

A FLAT-TOP desk is a good piece with which to begin the construction of modernistic furniture. By following the general method of construction shown above, a desk can be made with little difficulty from glued-up stock or $\frac{3}{4}$ " plywood. If some type of patented dovetailed and ready-glued lumber is available locally, it will serve the purpose very well. The wood may be hardwood, which can be stained and varnished, or inexpensive softwood, to be finished in colored enamel. Nails and screws may be used for the fastenings, and the top covered with either a hard-pressed composition board or plywood. Note the inclosed shelves on one side of this piece.

Standard tongue-and-groove stock is used for much of the second desk illustrated on this page. The front is paneled without draw-

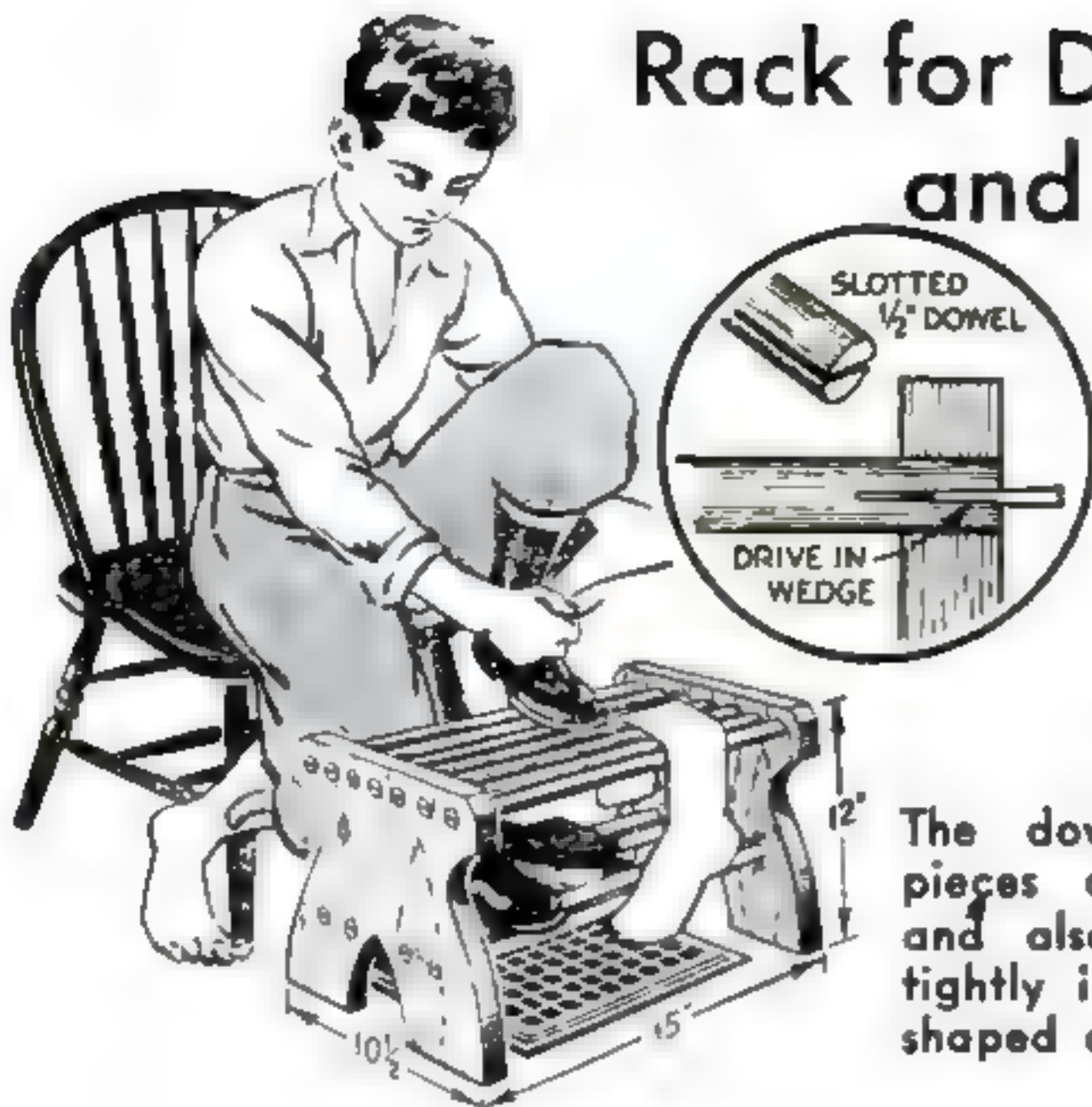


The use of tongue-and-groove stock reduces the cost of this desk

ers, but has inclosed shelves on the two sides.

In building the desk shown at the upper left of the facing page, 12" wide stock is used for the shelves and sides, and $\frac{3}{4}$ " thick plywood for the backs of the cases.

Rack for Drying Children's Shoes, Socks, and Mittens over a Register



IN HOMES heated by a hot-air furnace, it is possible to dry children's shoes, socks, and mittens quickly on a rack made as shown at the left. The end pieces should be jig-sawed or band-sawed from perfectly dry wood; dry it well in advance near the furnace in the basement if necessary. Drill the holes for the $\frac{1}{2}$ " dowels, slot the ends of the dowels with a saw, apply casein glue, and assemble the piece. Then drive in small wedges as indicated to make the joints secure. The rack may be used either against a wall register or over a floor register.—DICK HIXON.

The dowel cross-pieces are glued and also wedged tightly in the two shaped end pieces

Turtle-Shaped Bonbon Tray of Hammered Brass

THIS amusing turtle-shaped tray is made from three pieces of sheet brass, although copper or iron may be used, if preferred. The dimensions are for a tray suitable for serving bonbons or nuts.

The tray proper is cut out from 22-gauge brass, the leg and handle sections from 14-gauge. To give them a pleasing hammered effect, go over the metal with a ball-peen hammer. The tray is cupped by hammering it over a prepared depression in a block of hard wood. When placing the twist in the turtle's neck, clamp the head in a vise; then use a monkey wrench. Fasten the parts to-

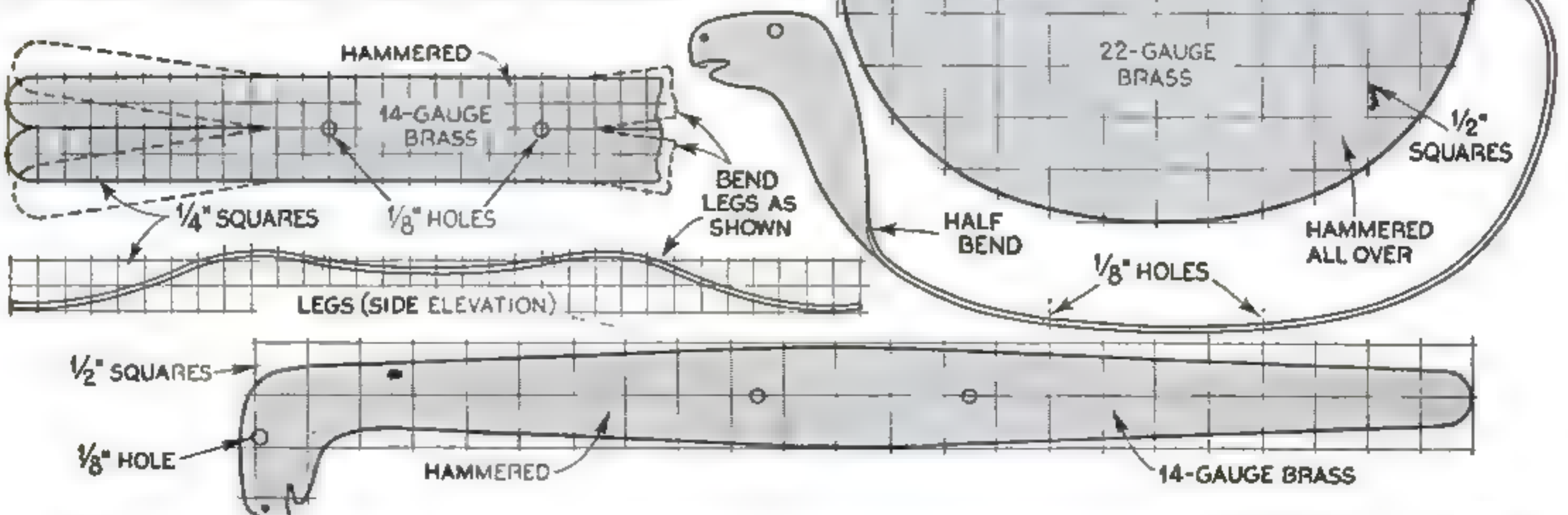
gether with two roundheaded brass rivets.

If the tray is to be used for food, several coats of clear varnish or metal lacquer should be applied.—GEORGE A. SMITH.

This amusing tray lends a humorous touch to the table



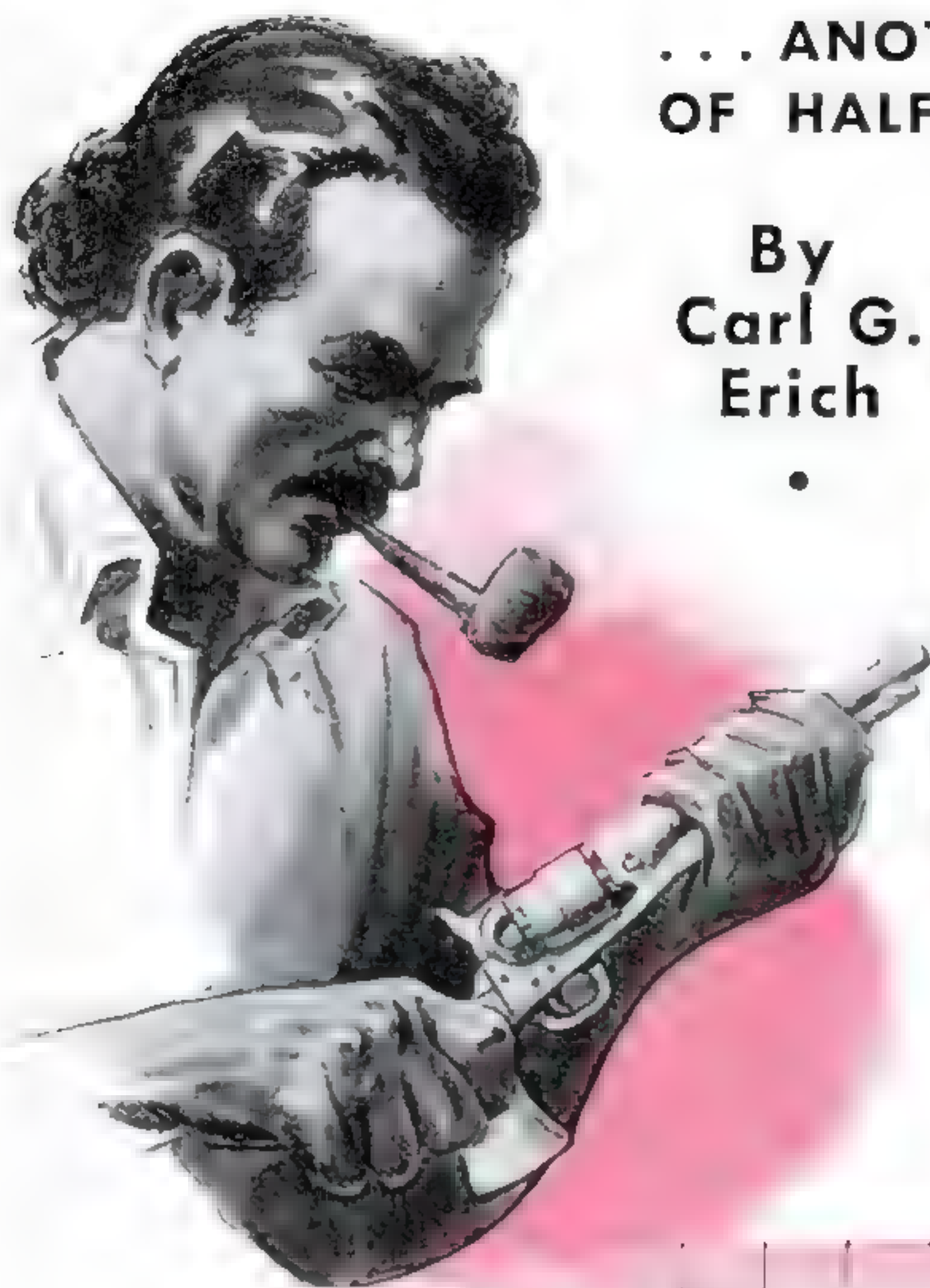
All three parts, which are cut as shown in the drawings, are polished before being assembled



Famous Army Revolver

... ANOTHER MODEL IN OUR SERIES
OF HALF-SIZE WHITTLED FIREARMS

By
Carl G.
Erich

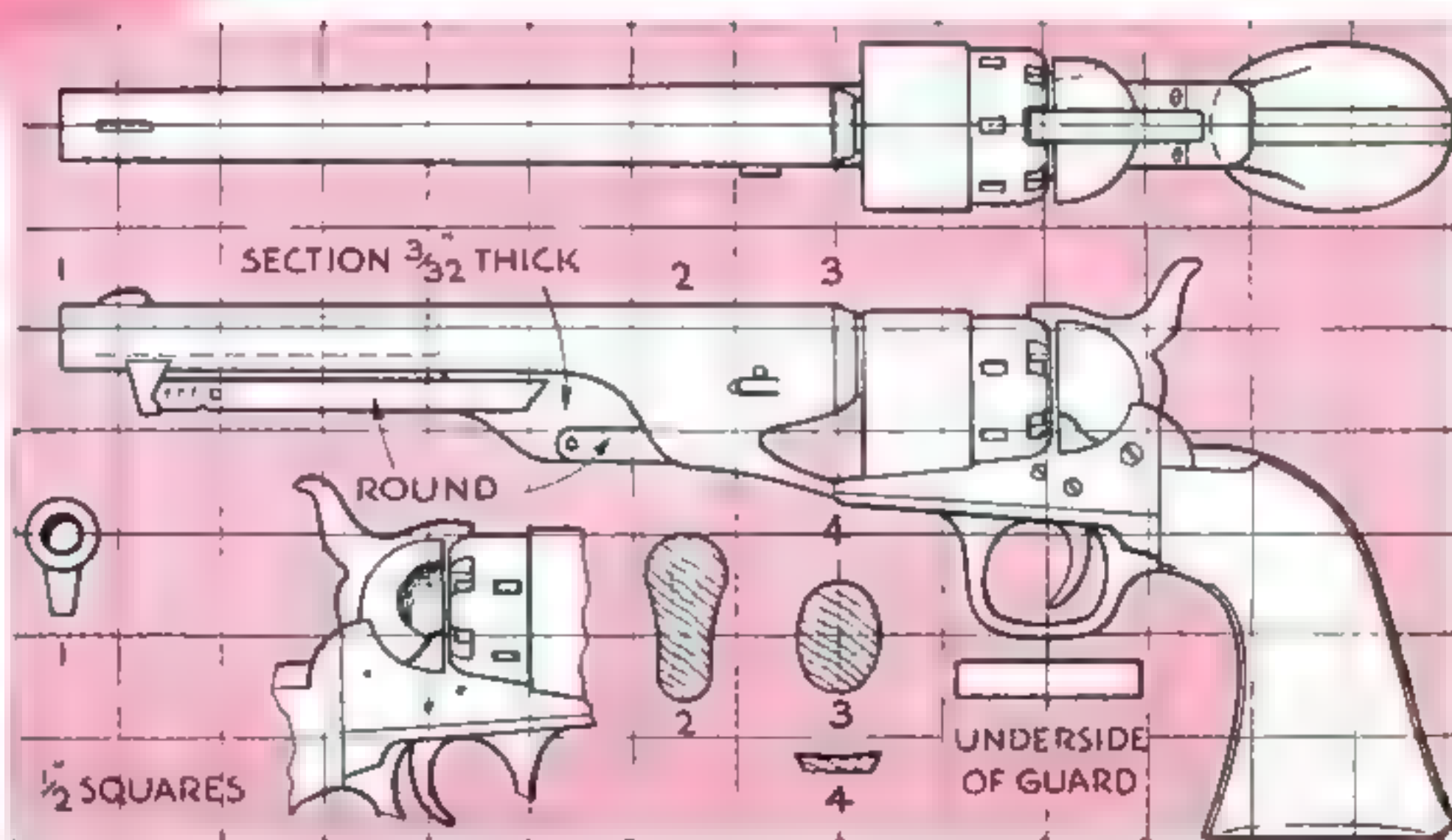


The model may be left in the natural wood or finished with gun-metal enamel and walnut stain

Any modern revolver would be a pigmy beside the 1860 Colt, 200,000 of which were made for use in the Civil War

MORE than 100 years ago, a Calcutta-bound seaman carved from a block of wood what was destined to be the world's most famous revolver. This genius was Samuel Colt.

Our half-size whittled model is of the Colt's .44-caliber U.S. Army revolver, model of 1860. Draw $\frac{1}{2}$ " squares on a white-pine board $\frac{7}{8}$ " thick, 3" wide, and 7" long. Cut out with jig or coping saw, but leave the outline on the wood. In whittling the shape, do not cut too long at one place. Keep turning the model so as to see that both sides are the same. Leave the delicate parts until last, for they are easily broken. When reducing the width of the hammer, trigger, and trigger guard, cut a little



Working drawings of the half-size model. These were made from careful measurements of the Colt's .44-caliber Army revolver, model of 1860

at a time and always carve across the grain.

I made the screw markings by taking a brass tube about $\frac{1}{8}$ " inside diameter and reaming it out at one end until the edge was sharp. This gives the size of the larger screw. The other end I ground down on the outside until sharp; this made the small screw heads. A small groove is then cut across these screw markings on the gun.

Renewing the Fronts of Old Built-in Cupboards

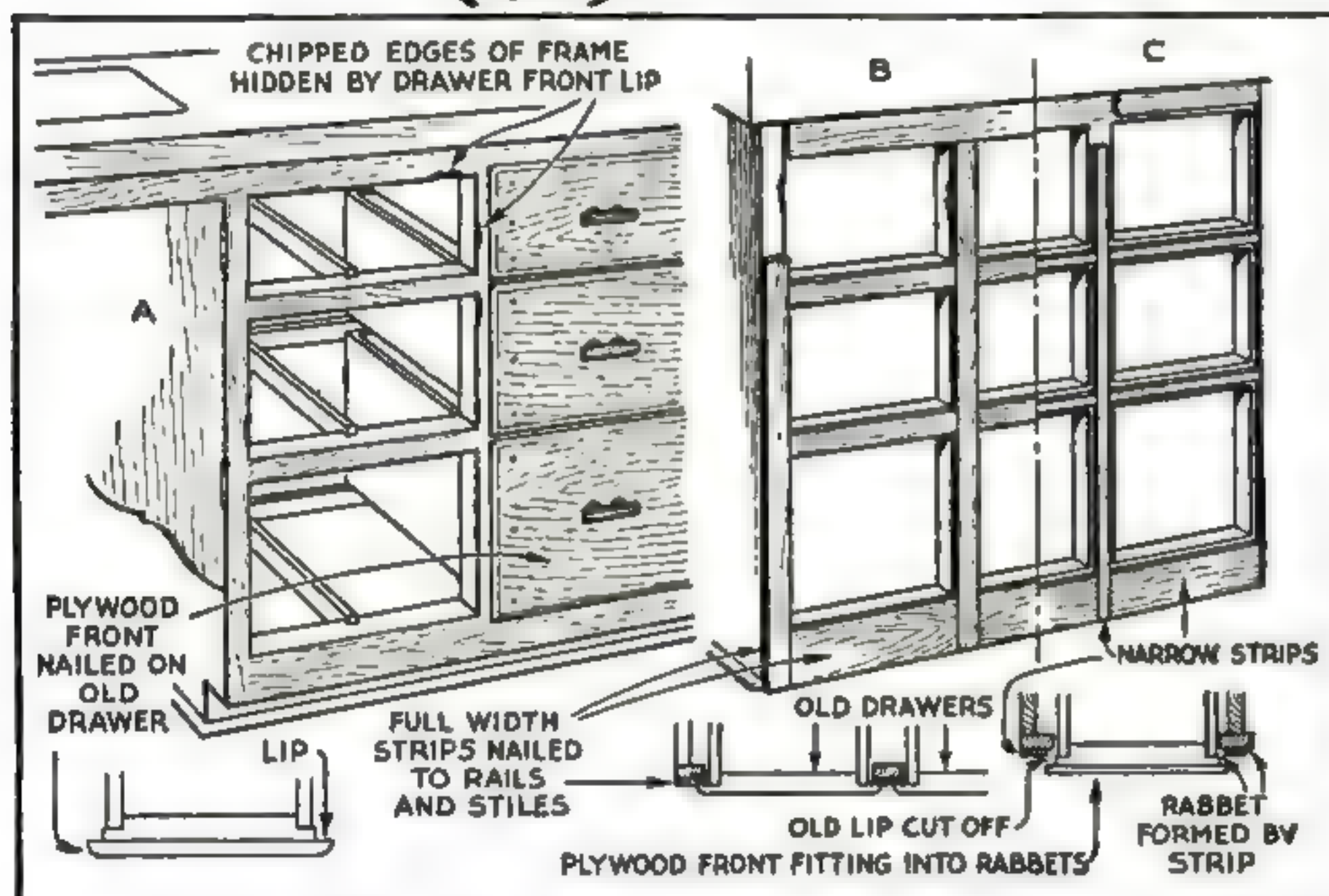


OLD kitchen cupboards and other built-in cabinets can be made to look as if they were new by simple "face-lifting" operations that conceal the battered fronts. In the drawings below, A suggests the method to use where flush drawers fit between narrow rails and stiles that have badly chipped corners. Cut $\frac{1}{4}$ " plywood fronts for the drawers and nail them on, allowing them to project so that, when in position, they can be fitted to each other to form a new flush front. If preferred, the corners may be rounded, giving them a lip-drawer effect.

Where wide stiles and rails are used with lip drawers, simply nail on thin wood strips, making a false frame front as at B. The old lip drawers are used as before. If a flush effect is wanted in order to eliminate projecting edges that catch the dust, face the rails

and stiles with narrower strips, forming rabbets; cut off the drawer lips; face the drawers with plywood so as to project, and fit the new lips into the rabbets as illustrated at C.

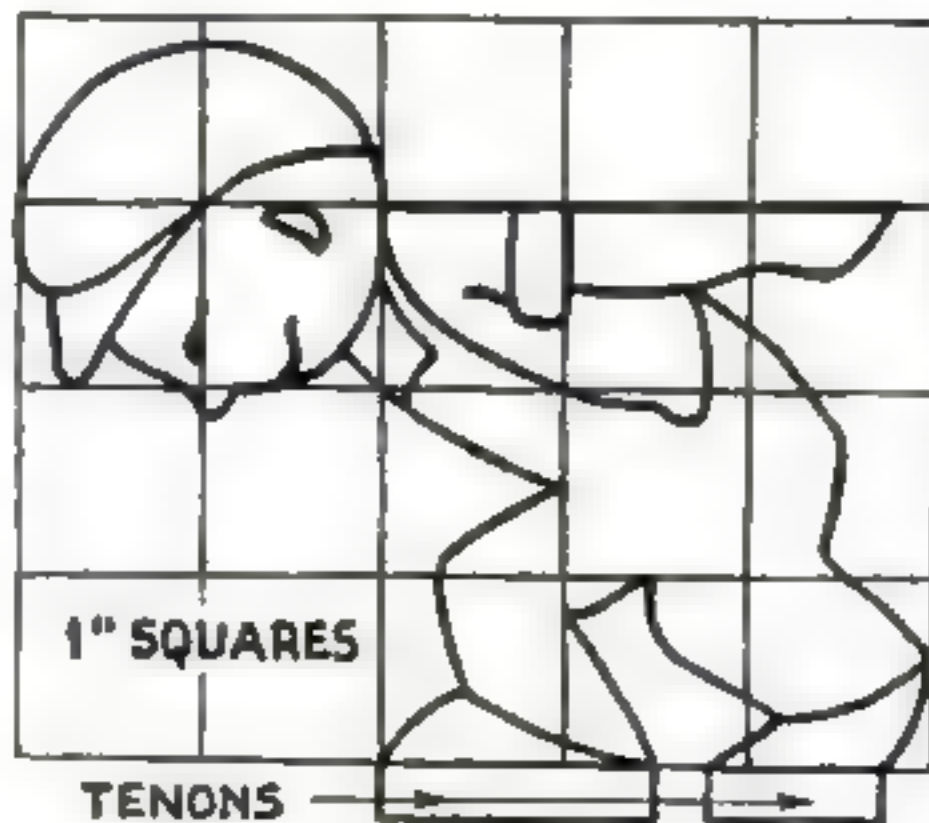
By the same means, doors and their stiles can be renewed.—EDWIN M. LOVE.



At A, new drawer fronts are applied; at B, new facings; at C, both

A Smile-Provoking Ash Tray

THIS overall-clad workman staggering under the burden of an ash tray is an amusing little novelty. The tray itself is merely a tin lid, fastened with screws to its support. Enlarge the pattern to full size and saw the figure from a piece of 1" thick wood. Use a piece of the same material $3\frac{1}{2}$ " by 5" for the base. Cut mortises in it to receive the two tenons left projecting below the figure and round or mold the edges. Here is one of many possible color schemes: black base and tray, yellow overalls and cap, and white shirt and shoes.—H. F. S.



The figure of the workman is sawed from 1" thick wood according to the pattern at the left. The tray is nothing more than the lid of a can

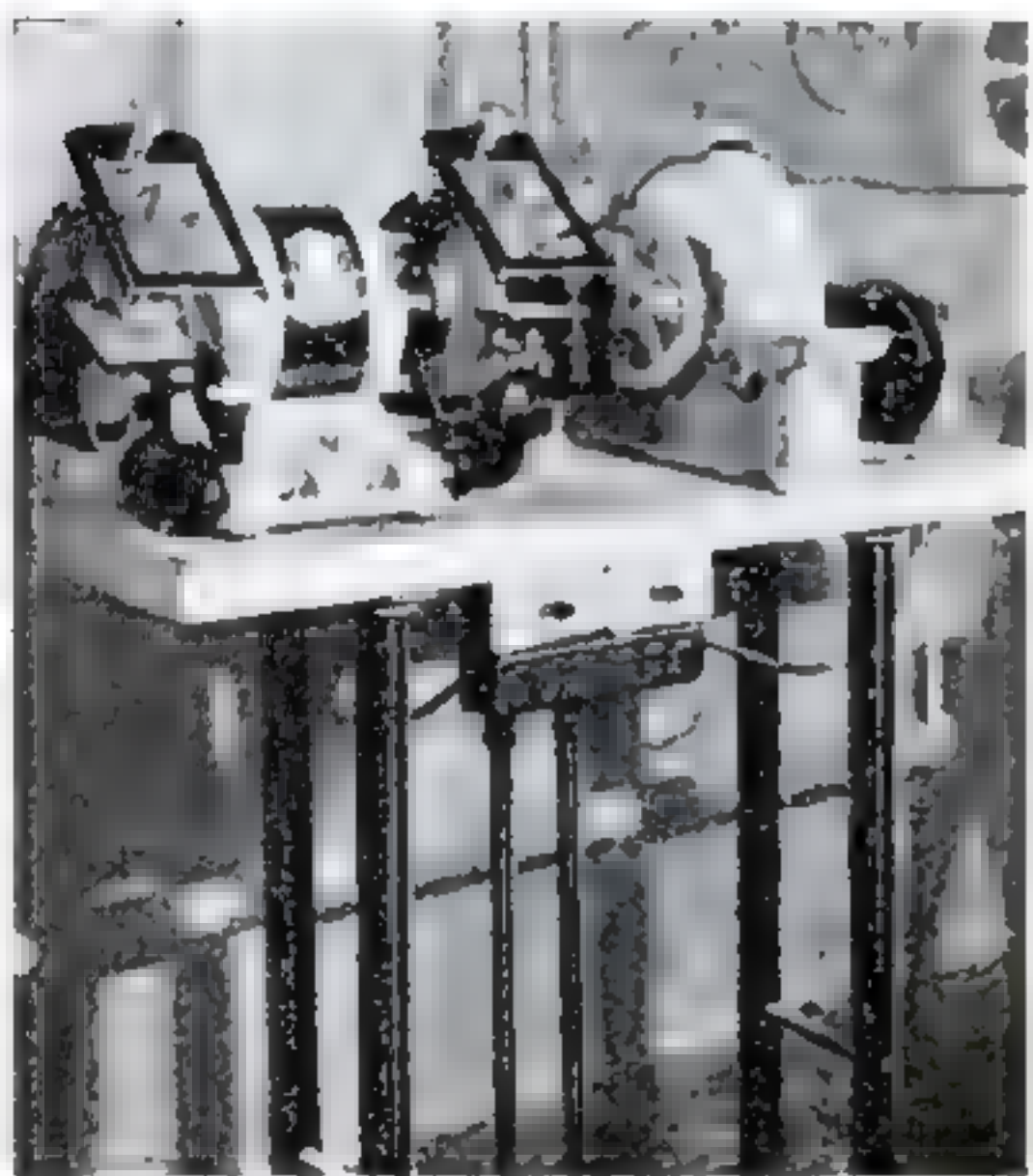
Unusual Variety of Marble Game Played Indoors on a Rug

AN ENTERTAINING indoor marble game may be played by placing on a rug in the center of the room an empty candy box in which a 2" diameter hole has been cut as shown. Two or more players sit from 3' to 4' from the box and endeavor in turn to throw a marble onto the floor so that it bounces into the hole. Any marble that does this counts 100 points. Marbles that are thrown directly into the hole count 25 points or, in a more difficult version of the game, do not count at all.—D.S.G.



The object is to throw the marble so that it enters the hole in one bounce

A Compact, Heavy-Duty Bench for Grinding Equipment



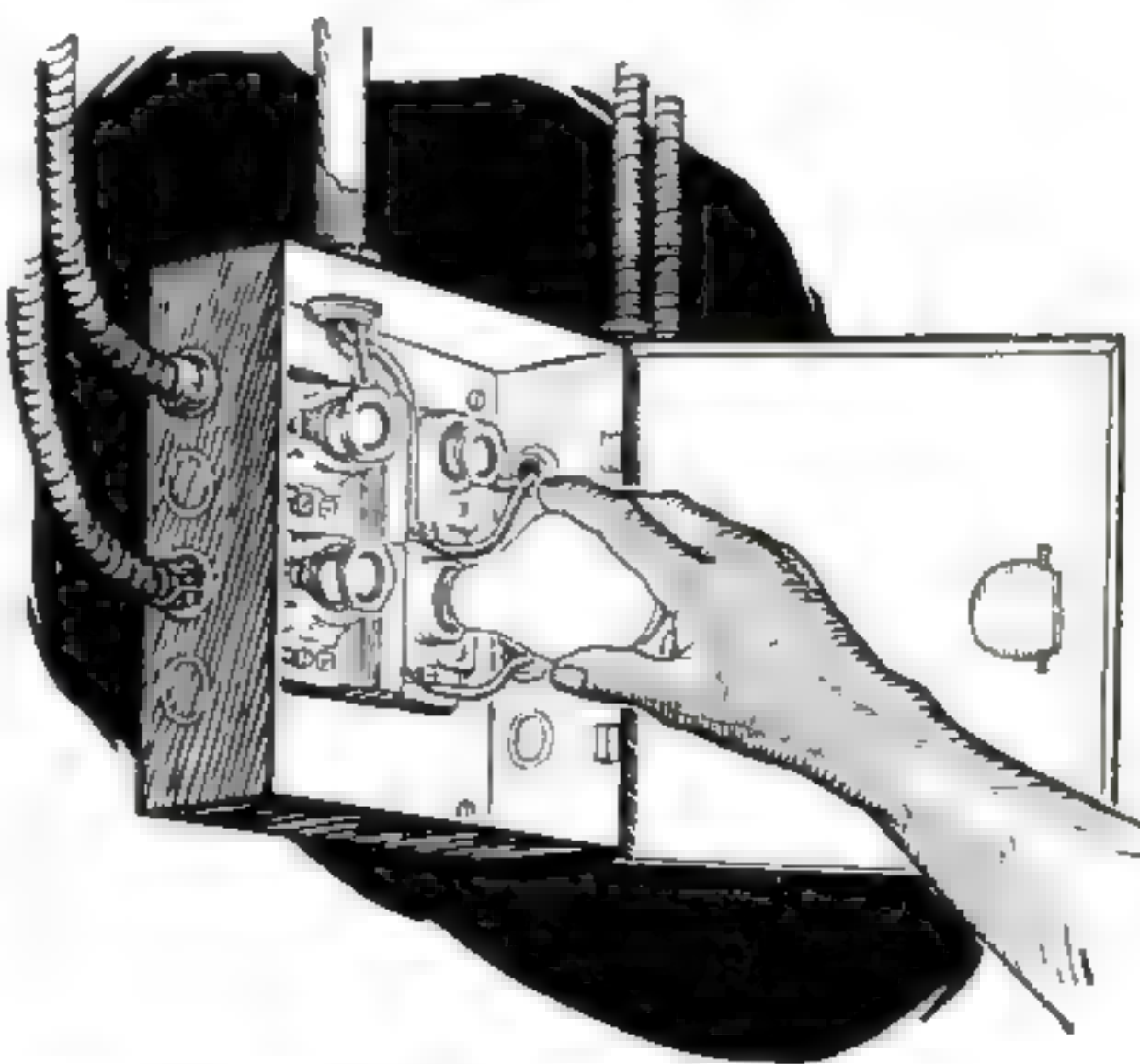
The bench carries an emery grinder and a small power-driven grindstone

IN A SHOP where space is at a premium, a compact grinding bench was made as shown with 1½" pipe legs and a 2" by 12" plank for the top. On this is mounted a heavy-duty emery grinder and a 10" power-driven grindstone. The electric power wiring is in conduit embedded in the concrete floor, and two switches are placed on the front of the bench, one to control each of the motors.—RAY BLAIN.

SHORT CIRCUITS

[ELECTRICAL]

When a fuse blows again and again, it indicates a short circuit, a ground, or an overload. To find a short circuit, screw an ordinary lamp in place of the blown fuse. This lamp will probably burn normally. Ask someone to watch it while you look for the trouble. First, pull out all lamp cords. This may clear up the difficulty, as cords are the worst offenders. When the short is removed, the test lamp will either go out or become dim. It also becomes dim if another lamp happens to be "on" somewhere in the circuit after clearing the line, for the two lamps burn in series. It may be necessary to look further, in which case check the switches, sockets, and fixtures. Insert a good fuse to restore service.



POPULAR SCIENCE MONTHLY SHOP DATA FILE

Deep Roll-Film Tanks

DEEP tanks, in which several rolls of film can be developed simultaneously, are generally thought of as available only in commercial developing plants. By the method illustrated, however, anyone can make a set of deep tanks that are not only efficient and durable, but can be folded up when not in use.

Old inner tubes are stretched taut between a top board, made as shown, and the floor. A section of each tube 45" or 55" long is cut out so that the valve stem is 6" from one end. The valve should be removed, and the metal parts of the stem inside and out treated with a chemical-resisting paint. Flatten the tube at the valve end, with the valve uppermost,

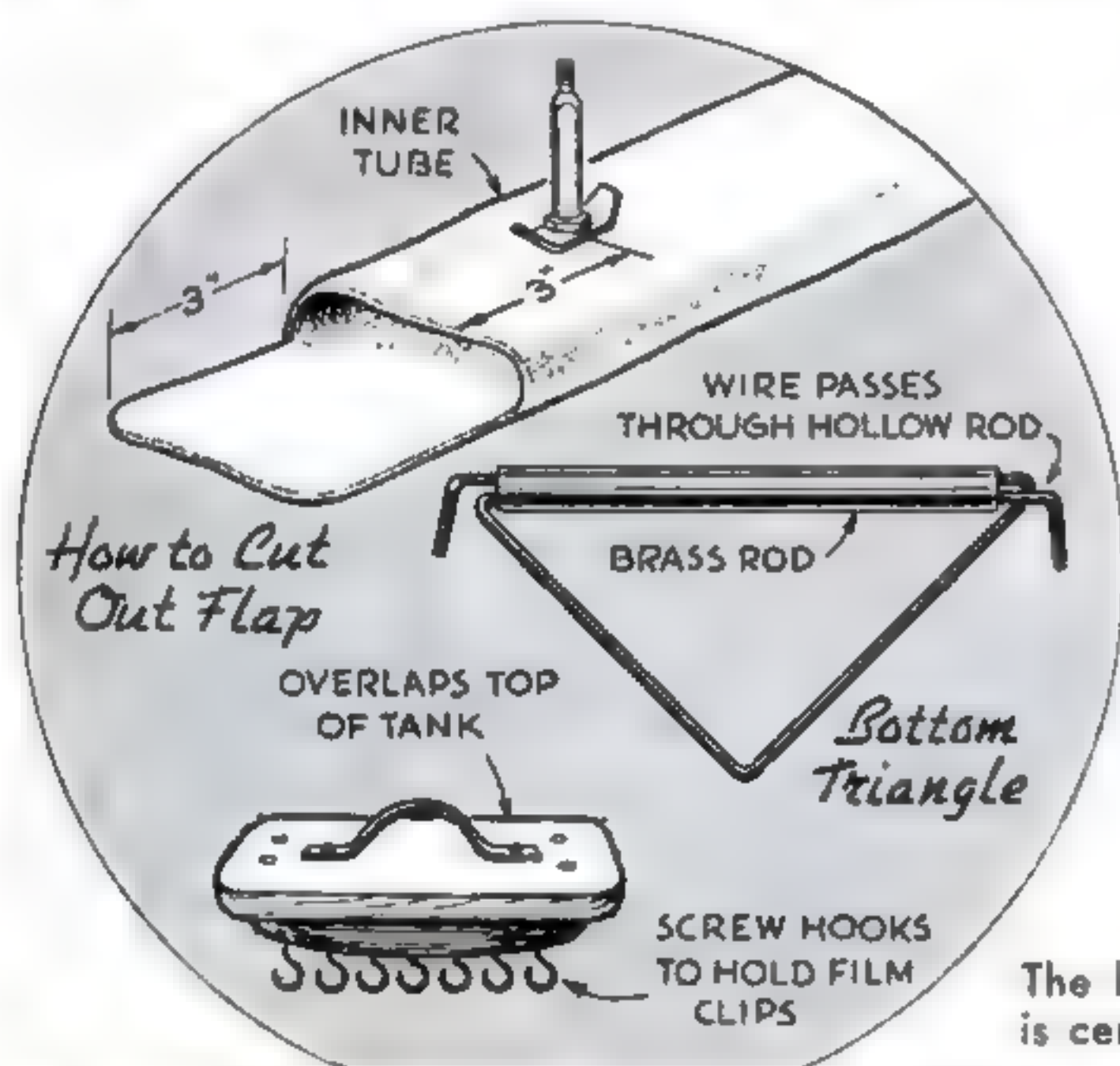
and cut away a piece of rubber the width of the tube and 3" long, leaving the under part as a flap.

A rectangular block large enough to distend the tube and be held in place by the pressure of the sides is cut from a 1" board. A hole is cut out of the center, and the corners and edges rounded to protect the rubber. The block is coated with very hot paraffin, then inserted just above the valve.

A piece of hollow brass curtain rod is cut 1" longer than the diameter of the flattened tube and mounted as shown on a length of coat-hanger wire. The lower end of the tube is sealed with rubber cement. It is important to roughen the rubber thoroughly, then apply a thick coat to both sides, which is allowed to become tacky. Then the inside of the flap and the outside of the tube where the flap folds over are similarly treated. The rod is laid at the base of the flap, and the flap folded over and very firmly pressed so that a strong union is formed.

For the top, a tin collar is provided as shown. The tube is slipped through the hole in the board from the bottom, then through the collar until it projects 2" or 3", and finally folded down over the collar. Large-headed nails are driven through tube and collar into the four sides of the hole.

Care should be taken that the three tanks are the same length so that the tension will be equal.



The lower end of a tube, the holder over which it is cemented, and the top for the tank of developer



In the top, about 1" by 12" by 36", three holes are cut 6" or 8" apart. Each is not quite as wide but slightly longer than the tube diameter



A paraffin-treated block is pushed into the tube to a point just above the valve



The flap at end of tube is folded over the curtain-rod tube and cemented in place

Made from Inner Tubes

Three strong screw hooks are fastened solidly to the floor directly beneath the centers of the three holes. Two shelf brackets are very securely fastened to the wall at a height sufficient to pull the tanks tight.

A light-tight top should be provided for the developer tank so that a normal light may be used in the darkroom even during development of films. A series of hooks in the underside of the top hold the film clips so that when the top is lifted out, the films lift out also, and can be examined with the safe-light.

A bar with several screw hooks serves to suspend the films in the other two tanks. The center tank, for rinsing and washing, may be connected to the water source according to available plumbing accommodations. Drainage may be accomplished by means of a siphon or through the valve at the bottom, although the latter is rather small.

A developer which resists oxidation is best to use, such as D76, DK76, or D52. Slow-working, fine-grain developers can be used without the back-breaking effort required for tray development. And although it is true that more developer must be mixed for the initial development, it lasts a long time if carefully handled and kept covered.

By John G. Roberts



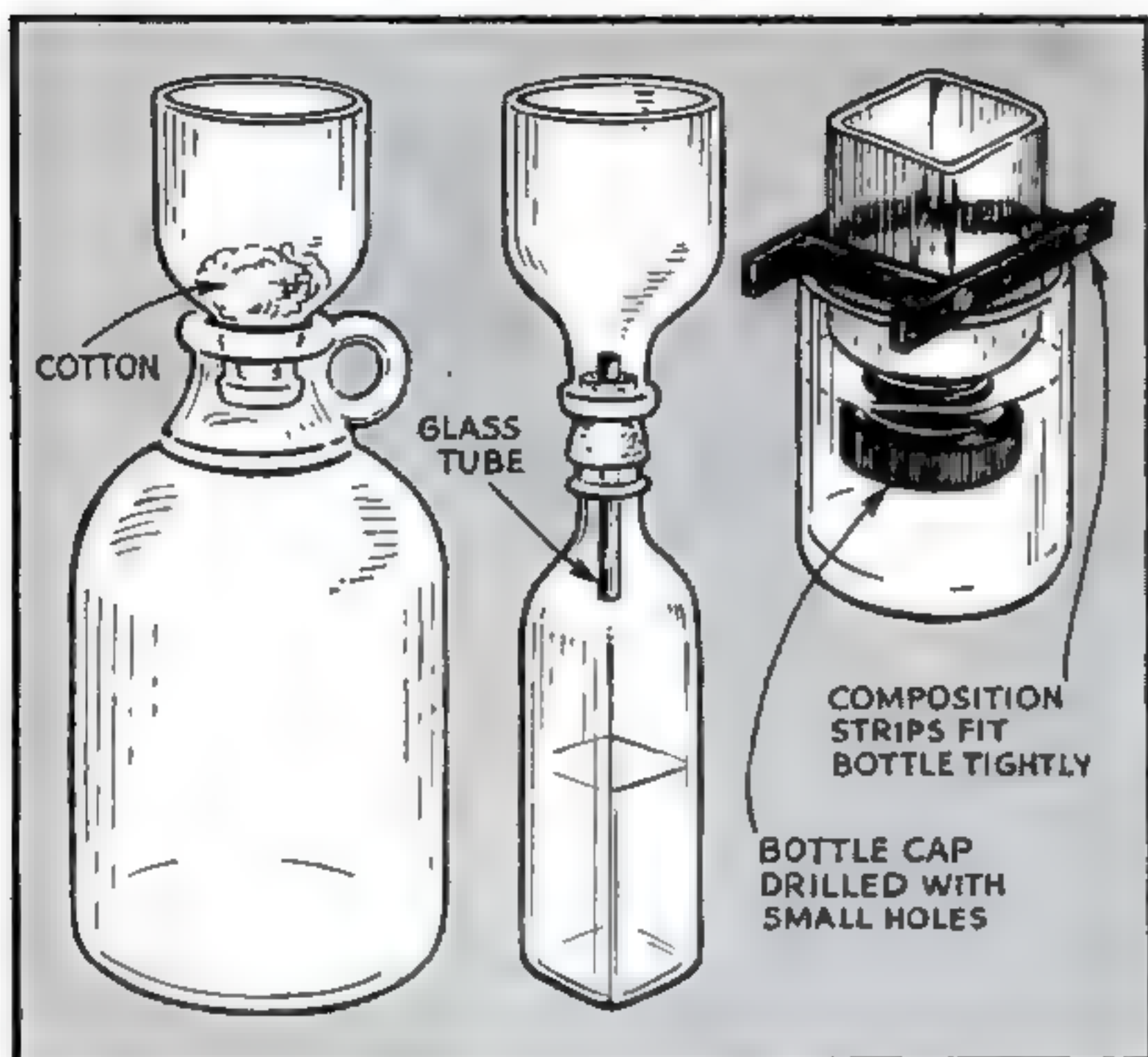
The top of a tin can is removed with a rotary cutter, and the can is cut down and carefully smoothed to form the collar at top of the tube



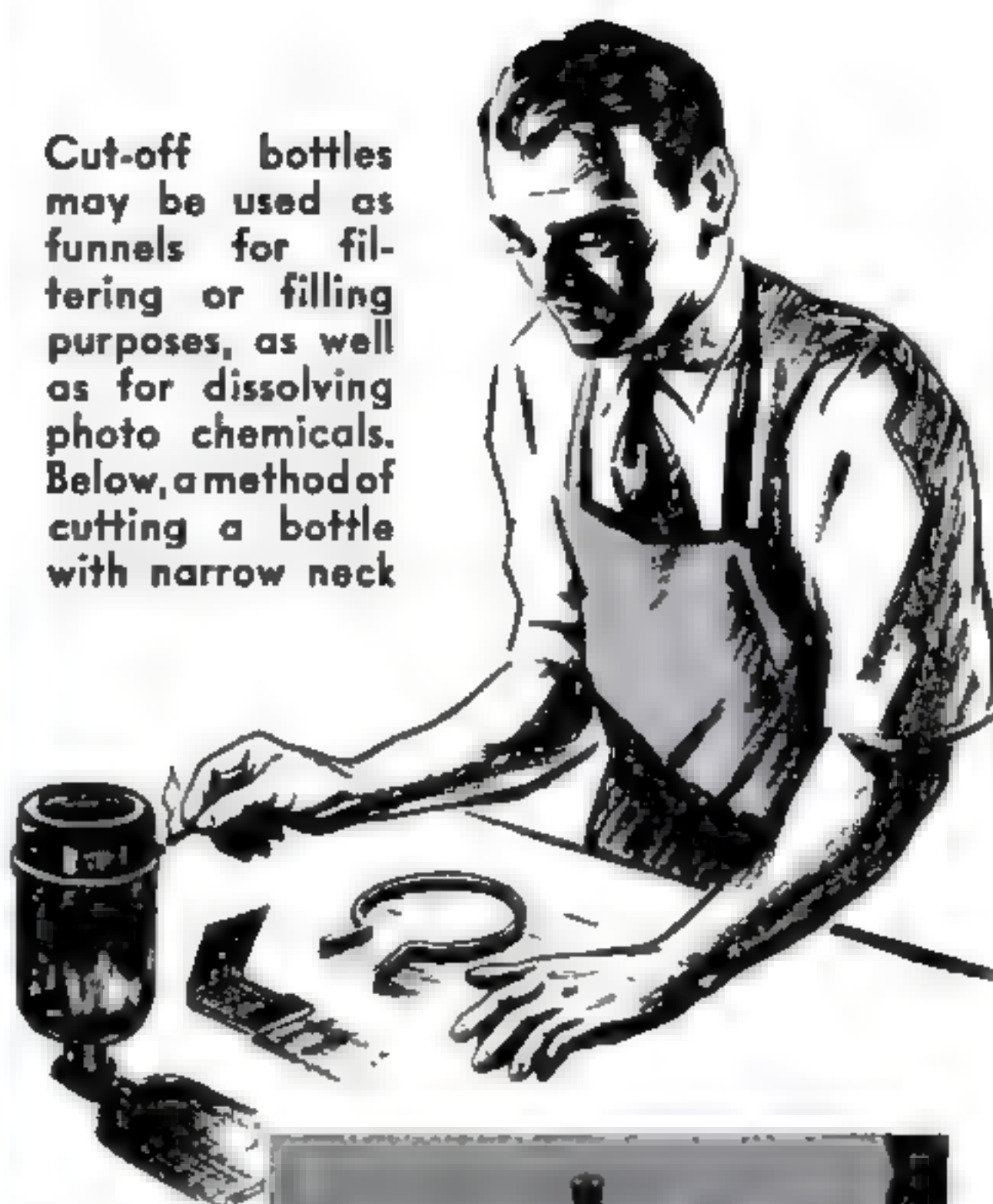
The tube is slipped through the board, then through the tin collar for about 2" or 3"



The tube is folded over the collar, pushed back into the top, and tacked or screwed



Cut-off bottles may be used as funnels for filtering or filling purposes, as well as for dissolving photo chemicals. Below, a method of cutting a bottle with narrow neck



Glassware for Use in the Darkroom Cut from Discarded Bottles

USEFUL glassware for the darkroom can be made from empty bottles. Large bottles can be cut off and made into jugs for mixing solutions. The upper half of an acetic-acid bottle, fitted with a cork and glass tube as sketched above, makes a good funnel for filling small-mouthed bottles; or, with a tuft of cotton stuck in the neck, it is handy for filtering solutions.

For dissolving developer powders, remove the bottom from a square bottle with a screw-on composition cap and drill holes in the cap with a No. 60 wire drill. Strips of hard composition are placed around the bottle and held by machine screws to form a hanger for suspending the bottle in a larger bottle or jar. In use, the hanger is adjusted so that the cap on the bottle reaches about 1" below the water level in the large jar. The chemicals are placed in the suspended bottle, where they will dissolve with little or no attention. A similar arrangement may be used for dissolving hypo. In this case a piece of cheesecloth is stretched over the mouth of a plain bottle and held by a rubber band.

Wide-mouthed bottles can be cut off with a sharp glass cutter by scoring around the outside and tapping the glass along the scored line from the *inside*. Narrow-mouthed bottles are scored near the end that is to be removed; then a soft cord is wrapped around the bottle over the scored line, saturated with alcohol, and ignited. The bottle, which will probably break rather unevenly, can then be cut off lower down by the other method.



A strip of metal will serve as a guide for cutting round bottles. Left, drilling holes in a composition cap

To make a straight cut on a round bottle, bend a strip of metal around the bottle as a guide as shown in one of the photos. The sharp edges of the glass should be removed with an abrasive stone.—MERLE TERRILL.

Contents of Home Movie Films Typewritten on Leaders

THE contents of 8- and 16-mm. movie films, instead of being marked on the reels, can be typewritten on strips of leader if these are first fastened, rough side up, on a piece of lined writing paper with adhesive tape. Apply film cement over the typewriting, and splice each leader to its film.—M. G. WINTERTON.



Curving Printed Letters

FOR making posters, special layouts, booklet covers, and the like, it is sometimes desirable to paste type-set letters around a curve, as shown. Take the proof bearing the desired type and cut it close to the top and ends of the letters, but leave about $\frac{1}{2}$ " at the bottom. This margin is folded up and creased about $\frac{1}{8}$ " below the line of letters. Cut between the letters down to this fold, coat the undersurface with rubber cement, and spread the letters fanwise to the required curve. After the letters are firmly secured, cut away the superfluous paper with a sharp razor blade or knife blade.—SIDNEY R. BAYNE.



Key-Ring Belt Hooks Prevent Clothesline from Sagging

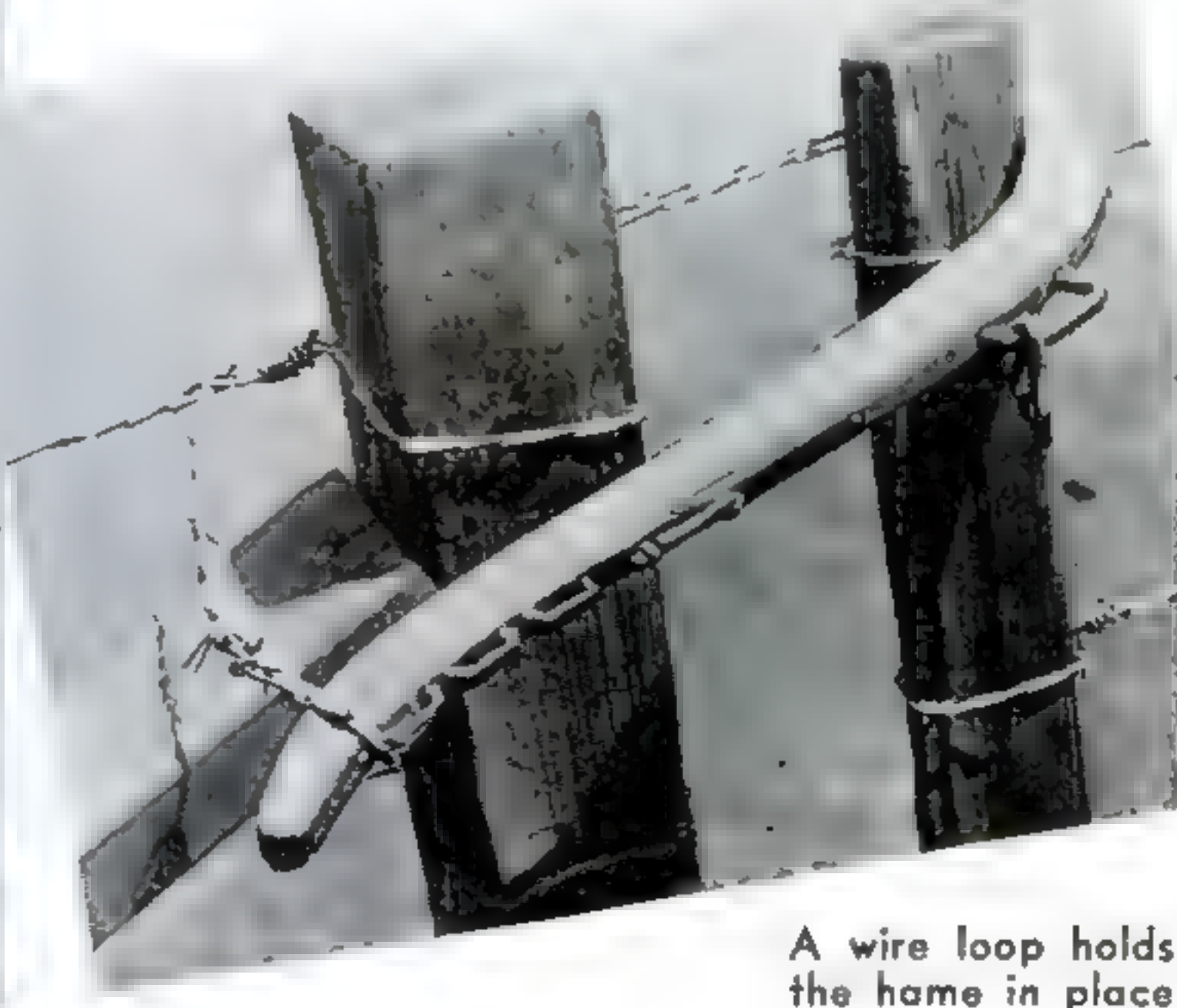
VARIOUS devices are sold to prevent clotheslines of the ordinary pulley type from sagging too much, but it is hard to find anything neater or more durable than nickel-plated key-ring holders such as are commonly used to fasten a key ring to a belt. Two can be obtained for a dime. They last longer than wooden or tin contrivances.—J. H. HOSACK.



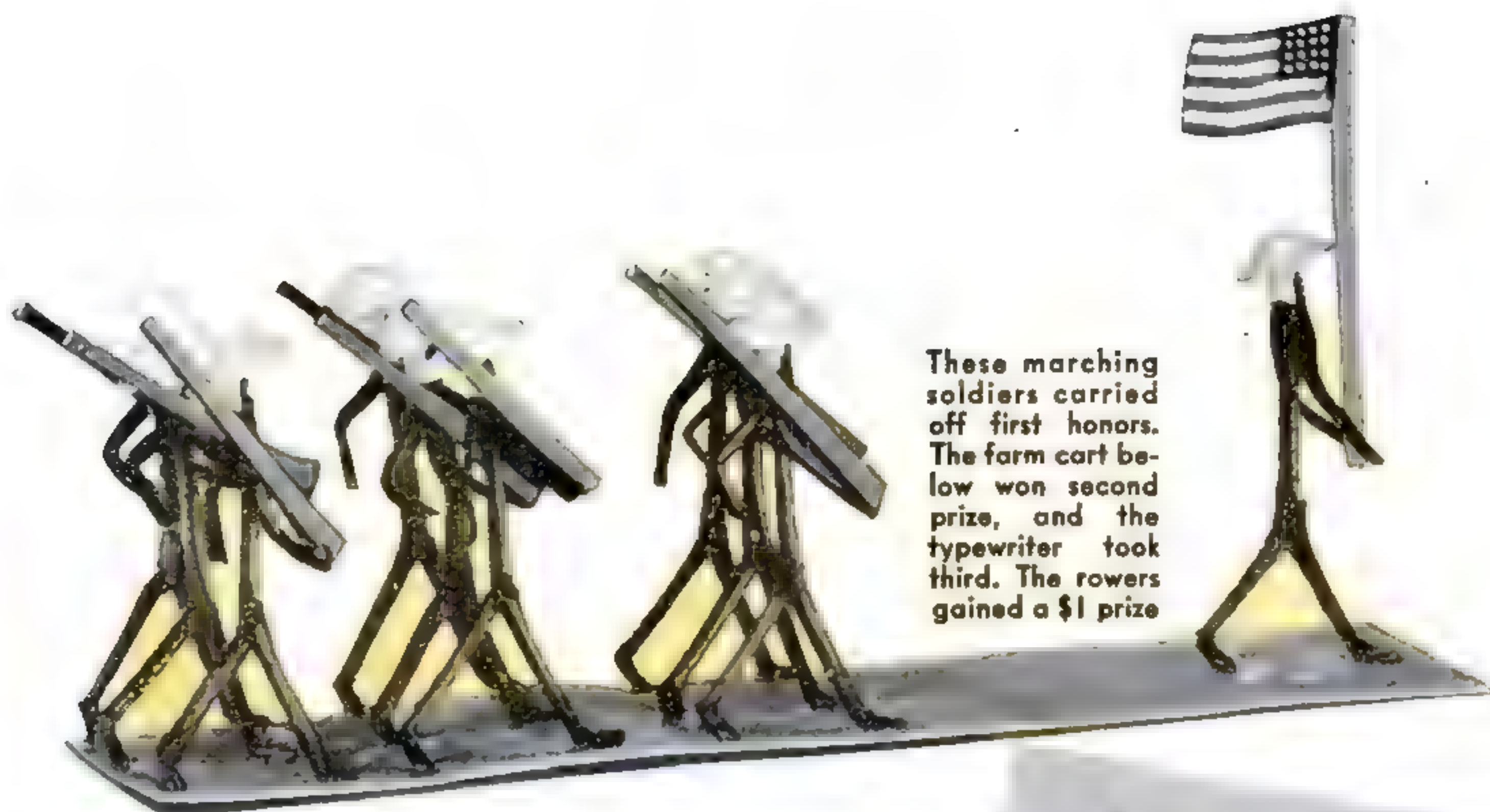
Key-ring holder keeps pulley clothesline from sagging

Discarded Hame Fastens Barbed-Wire Gate

FOR fastening a barbed-wire gate on a farm, it is possible to make an efficient and inexpensive device from a discarded hame as shown in the accompanying illustrations. It is a marked improvement over the old-style wire loop and other fastenings because of the leverage it gives. Most farms have old hames suitable for this purpose.—F.D.



A wire loop holds the hame in place



These marching soldiers carried off first honors. The farm cart below won second prize, and the typewriter took third. The rowers gained a \$1 prize

Winners OF BOOK-MATCH CONTEST



FIGURES ranging from dancers to trapeze artists; machines as diversified as lathes, typewriters, and steam shovels; animals varying from alligators to zebras; vehicles representing almost everything on wheels, from ancient chariots to farm wagons and automobiles; boats as unlike each other as racing shells, clipper ships, and aircraft carriers—these were among the hundreds of entries submitted in our book-match contest (P.S.M., Sept. '38, p. 55). Each was made from a single book of safety matches, the only additional materials that could be used being glue and paint.

Such remarkable ingenuity and imagination were displayed by the contestants that the judges had a difficult task deciding the winners. Because of ties, several extra \$1 prizes were awarded. Some of the best and most amusing designs are pictured on these pages.





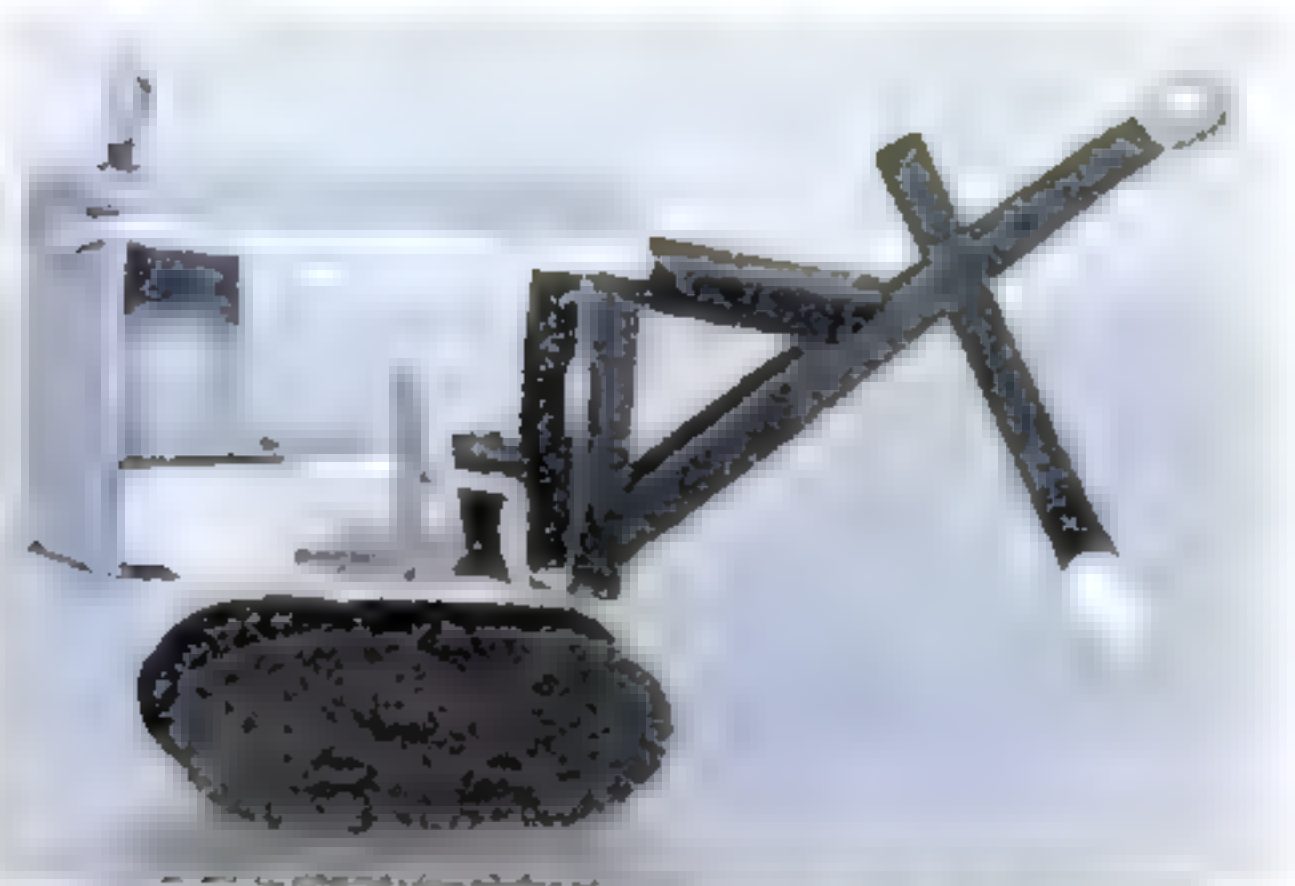
Skeleton with head molded in pulp made from left-over bits



Red match heads form the footlights of the stage on which these dancers perform



Many amusing animals were received, including a cow



A sturdily built steam shovel. The chassis is actually mortised together

And this is Striking Match, the Indian. His fiery red nose matches the tips of his headdress



Here Are the Awards

FIRST PRIZE, \$25

William Morsing, Irvington, N.J.

SECOND PRIZE, \$15

Joseph Charewicz, Worcester, Mass.

THIRD PRIZE, \$5

Walter Morrison, Eveleth, Minn.

\$1 PRIZES

George A. Black, Buffalo, N.Y.; Orville Buser, Bradley, Ill.; John Dewey, Olive View, Calif.; Harold O. Henderson, Chickasha, Okla.; Miss B. Hoyt, Wappinger Falls, N.Y.; Miss Stephanie Mandziak, New York City; Warren R. Petersen, Brooklyn, N.Y.; J. Putzer, Oshkosh, Wisc.; Joseph Tanner, Secaucus, N.J.

HONORABLE MENTION

Fritz W. Arend, West Allis, Wisc.; E. C. Bacon, Jackson Heights, N.Y.; Rev. C. W. Baker, Duquesne, Pa.; Virginia Baxter, West Allis, Wisc.; W. D. Beal, Chestnut Hill, Mass.; Calvin Boston, Westbrook, Tex.; John Bujant, Fleming, Ky.; Stanley Carland, Asheville, N.C.; Elizabeth Carpenter, Mt. Vernon, N.Y.; Anthony C. Charewicz, Worcester, Mass.; Katherine Cooper, Burlington, N.J.; Robert J. Crowell, Marblehead, Mass.; George J. Dahlgren, St. Louis, Mo.; Douglas F. Darrah, Viking, Alta., Canada; Leo Ehrmann, Brooklyn, N.Y.; Bert Engleman, Asheville, N.C.; Edward France, Jr., Upper Montclair, N.J.; William F. Gehrig, Berkeley Heights, N.J.; Frances Haas, Ridgewood, N.Y.; Emma Hawkins, New York.

Charles A. Hazard, Peoria, Ill.; Jacob J. Hess, Freeport, Ill.; Ernest F. Hogan, San Francisco, Cal.; John Hoffman, Duquesne, Pa.; K. Hollis, Coldwater, Mich.; Miss R. Hoyt, Brentwood, N.Y.; Mrs. Lydia Kemmeley, Boonton, N.J.; Alfred H. Kestner, Glenburnie, Md.; Walter Keyes, Winston-Salem, N.C.; John R. King, Cumberland, Md.; John E. Kinister, Wisconsin Rapids, Wisc.; Barney Lifshay, Jackson Heights, N.Y.; L.M. Logan, Washington, D.C.; Miss Agnes Marz, Chicago, Ill.; Bryan Millard, Sioux Falls, S. Dak.; Lina Mae Moffitt, Ashboro, N.C.; Mrs. Frank Monteith, Caldwell, Idaho; Stephen Naurath, Jr., Ridgefield Park, N.J.; Jack Parry, Drumheller, Alta., Canada.

Fred Reibert, Jr., New York City; David K. Richards, Woodbury, Conn.; Lester V. Sebring, Spencer, Mass.; Thurlow Shiflett, El Reno, Okla.; Edwin Smart, Pontiac, Mich.; Donald Smith, Marcy, N.Y.; L.K. Smith, Norfolk, Va.; Jay Spannuth, Uniontown, Pa.; E. Strong, Brooklyn, N.Y.; Mrs. William G. Swafford, Jr., Chattanooga, Tenn.; Eric Traugott, Jersey City, N.J.; G. H. Wallace, Pittsburgh, Pa.; Mrs. H. Weber, St. Louis, Mo.; Richard R. Werner, Beaver Dam, Wisc.; Carl L. Wiehe, Custer, S. Dak.



Uphill on Skis!

Every skier should know how to climb without undue fatigue by making use of one of the various available aids

CLIMBING uphill on skis is at best very hard work, yet no one can really claim to be an expert skier without knowing how it is done. In open country it is, in fact, essential to know how to climb without undue fatigue.

One reliable aid is a pair of ski socks—canvas bags about 2½' long that slip on the back half of the skis. They are good in any kind of snow, including even a hard, crusty surface. For each ski obtain a rectangle of heavy canvas 2½" longer than the length of the back of the ski from the footplate to the end. The width should be 1" more than double the width of the ski with an additional allowance for the seam. Fold over and sew a 2" cuff at one end. Then fold the canvas lengthwise, sew or rivet (sew-

ing is preferable) the seam and the other end, and turn the bag inside out.

Rivet a 6" piece of ½" wide leather to the open end of the bag as shown to project 4" or more beyond it. The attachment will be stronger if another scrap of leather is placed on the inside to prevent the rivets from pulling through the canvas. Finally, a short piece of leather with a small buckle is attached to the *outside* edge of the ski. Normally this will come about opposite the instep or arch of the boot. The sock itself, it will be noted, fails to reach the footplate by about 1½"; this is to allow for stretching. The socks should be large enough to slip on and off easily. When not in use, they are hung on the skier's belt or placed in a knapsack.

Another good device is the knotted rope sock, which was de-

By
ARTHUR HOLMES

Ranger, Yosemite National Park

scribed in a previous article (P.S.M., Jan. '38, p. 68).

Sealskins also are excellent for climbing. These are supplied by ski dealers and are merely two strips of sealskin mounted on canvas and tied to the undersides of the ski. The hairs lie so as to engage the snow when climbing, but they slide forward readily. A variation used in Yellowstone National Park consists of a rectangle of elkskin about 1" by 6" permanently mounted in a shallow rectangular depression on the bottom of each ski directly under where the foot rests. For gently rolling country this type is both inexpensive and efficient.

Various patented mechanical devices are available for climbing, but in my experience they are not especially successful in practical use under a variety of changing conditions.

Finally, there are many wax preparations which, when properly applied, reduce the back slip yet provide a fast gliding surface for down runs. Unless steep slopes are to be negotiated, special climbing waxes give the best aid in climbing.

The explanation of why a wax can aid in climbing is simply this: Snow is made up of minute crystals, which have sharp points when first formed in temperatures well below freezing. When the ski is in motion, the crystal points cannot penetrate the wax surface and have no slowing-up effect, but the moment the gliding motion is halted and the skier shifts all his weight on one foot, as when taking a step forward, the sharp points individually penetrate the wax and tend to hold the ski. Releasing the weight from the ski frees these points, and the ski can slide over the snow freely.

When, however, the temperature is near or above freezing, the points melt and lose much of their sharpness. In this case a softer wax must be used. If the soft wax were used in cold, new snow, the sharp points of the crystals would penetrate too far and cause the snow to stick to the bottom of the skis,

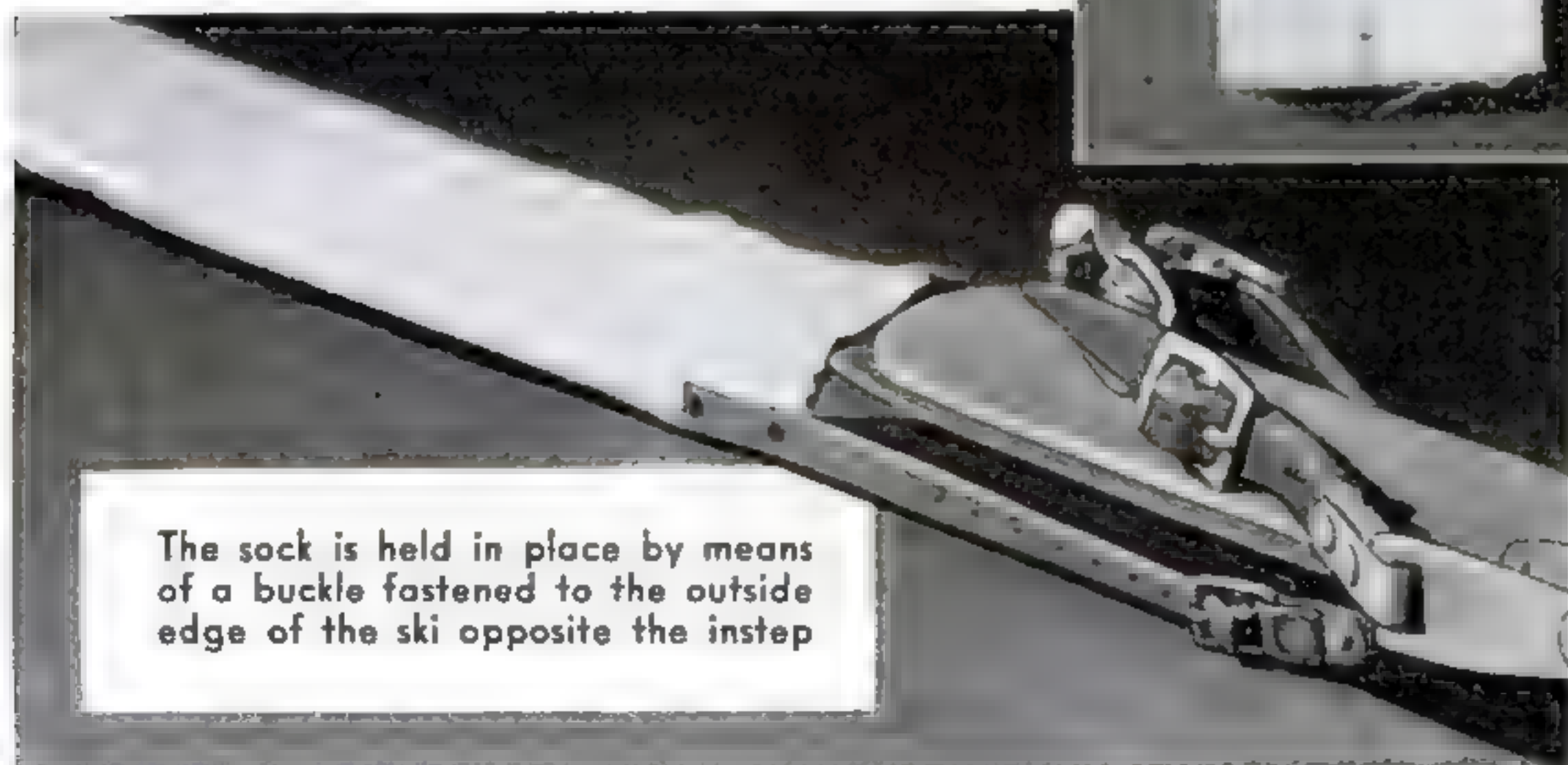
which would be about the worst condition a skier can encounter. Pick one brand or series of waxes and concentrate on using the various preparations until you learn which to choose for every condition.

There are, of course, so-called "all-purpose" waxes for new snow, wet snow, old snow, crust, and the like. These are satisfactory, too, but here the skill lies in putting on the wax in a thin coat, thick coat, rough coat, and so on, to give the desired climbing properties. Beginners will find it best from the very start to use special climbing waxes.

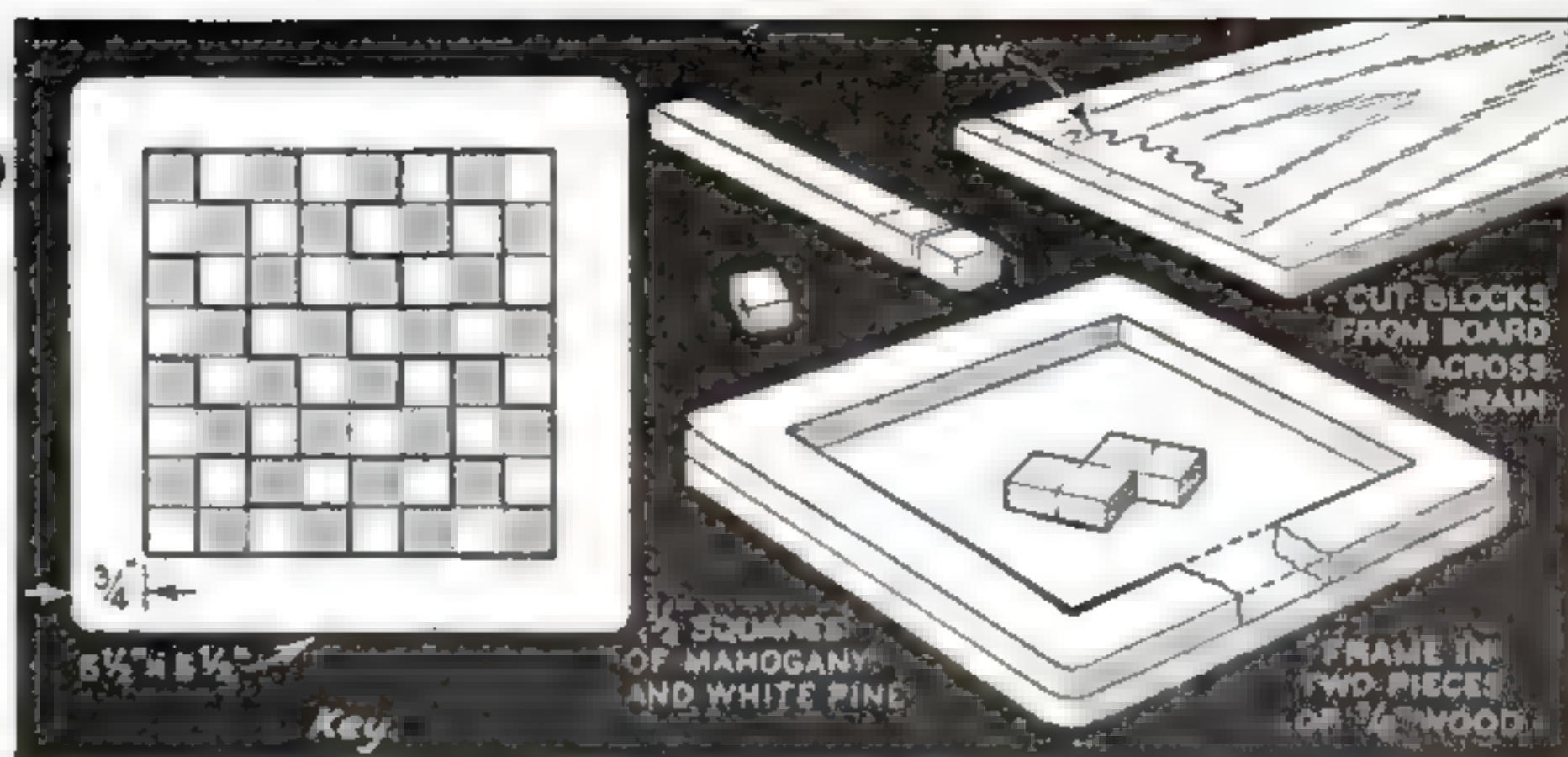
Aside from these aids, there are various methods or techniques of climbing, the three most common being contouring, side-stepping, and the herringbone, but these are covered adequately in all instruction books.



Ski sock of canvas before and after being sewed up. It is made to fit loosely over the rear portion of the ski from the footplate to the end



The sock is held in place by means of a buckle fastened to the outside edge of the ski opposite the instep



Small blocks of white pine contrasted with mahogany are glued and clamped together in the shapes shown

A Checkerboard Puzzle That Baffles Experts

THIS checkerboard puzzle looks easy enough, but wait until you try it! It has baffled experts, and amateurs have spent hours over it.

The frame is a square piece of wood—preferably with an attractive grain or tone—and a second piece of the same material cut out in the center and glued on top of the first.

The puzzle blocks are in two shades of wood, such as white pine contrasted with mahogany or redwood. These are sawed individually, then glued and clamped together. When the glue has set, finish them with a disk or belt sander, or by hand, and apply two coats of shellac. Do not fit them too tightly or they may bind in the frame in damp weather.

Drills Made from Music Wire Aid Model Makers

BECAUSE of high cost and breakage, very small twist drills are usually a trial to the model maker, especially when used in a hand drill. For several years I have been using music wire to make my own drills for holes from 0.006" to 0.033". The wire is hard enough for drilling wood, plastics, brass, and even mild sheet steel.

The point is formed by first grinding the wire to a 60-deg. chisel point, then grinding away the corners so they form an included angle of about 120 deg. The sharpening is

done with an oilstone and consists in relieving the lips to give the drill its lead. By mounting a drill 12" or longer in a chuck and then guiding the tip by hand, it is possible to reach otherwise inaccessible places in the interior of boat hulls, airplane fuselages, and similar work.—GODFREY BELL.

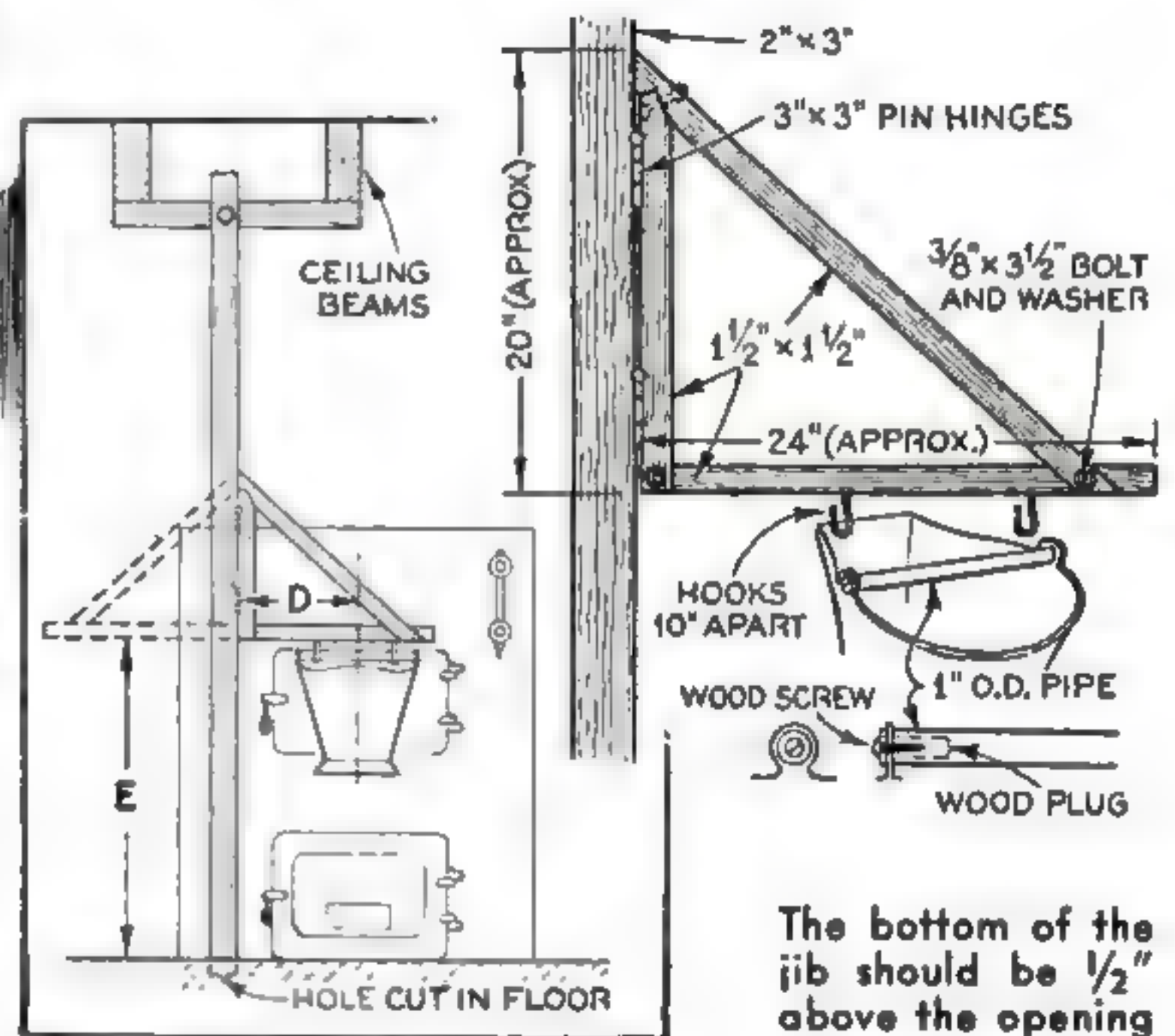
Inner Tubes Hold Ladder Carried on Top of Car

TO CARRY a small extension ladder on the top of my car, I hunted up two old inner tubes that would hold air, inflated them moderately, and laid them on the top, one near the front and the other near the back. The ladder was placed on top of the tubes and roped securely to the front and rear bumpers. I have also transported a canoe in this manner for twenty-five miles with no shifting and not a mark on the car. To make good contact, wipe both the auto top and the inner tubes free of dust.—GLEN E. FLINT.



With points ground as at left, these wire drills are fine for reaching otherwise inaccessible places, such as inside a model

Coal Scuttle Suspended from Crane to Save Housewife Work



ANY man who wants to relieve his wife or mother from the task of shoveling coal into a furnace can do so by making a hand-operated stoker of the type illustrated. It is just an ordinary coal scuttle so mounted that when the fire door is opened, it can be swung around and emptied into the furnace. The man who tends the furnace can load the scuttle before going to work.

The drawings are self-explanatory, but it is important to make the center between the two hooks about 1" nearer the 2" by 3" post

than a vertical line passing through the center of the fire-door opening, as indicated at *D*, so that the scuttle will swing freely into the fire door. It is also desirable to keep the bottom of the jib about $\frac{1}{2}$ " above the top of the fire-door opening, as shown at *E*. If loose-pin hinges are used, the crane can be removed in summer.—H. S. THOENEKE.

REMOVING VERY HARD PAINT AND VARNISH

[PAINTING]

Old paint or varnish that is exceptionally thick and hard can be removed by the following method:

1. Make up a strong boiled starch solution, and add one pound of soap lye per gallon of starch.
2. Apply this to the painted or varnished surface with a vegetable fiber brush. The solution will dissolve the animal bristles of an ordinary brush. Use rubber gloves. Have a bottle of strong vinegar at hand to apply to any spatters on the skin.
3. Scrub loose with another brush and wash clean with water.
4. Neutralize with strong vinegar.
5. Dry and sand clean.

NOTE: This type of remover is also useful when standard commercial paint and varnish removers cannot be used for any reason; for example, where there might be danger of fire, or the surface is of such a nature that it would be difficult or impossible to remove all traces of the paraffin contained in the remover.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

U. S. Light Cruiser

'PHILADELPHIA' CLASS

A Miniature Model
Designed Especially for
the POPULAR SCIENCE
MODEL-of-the-MONTH CLUB

By

THEODORE
GOMMI

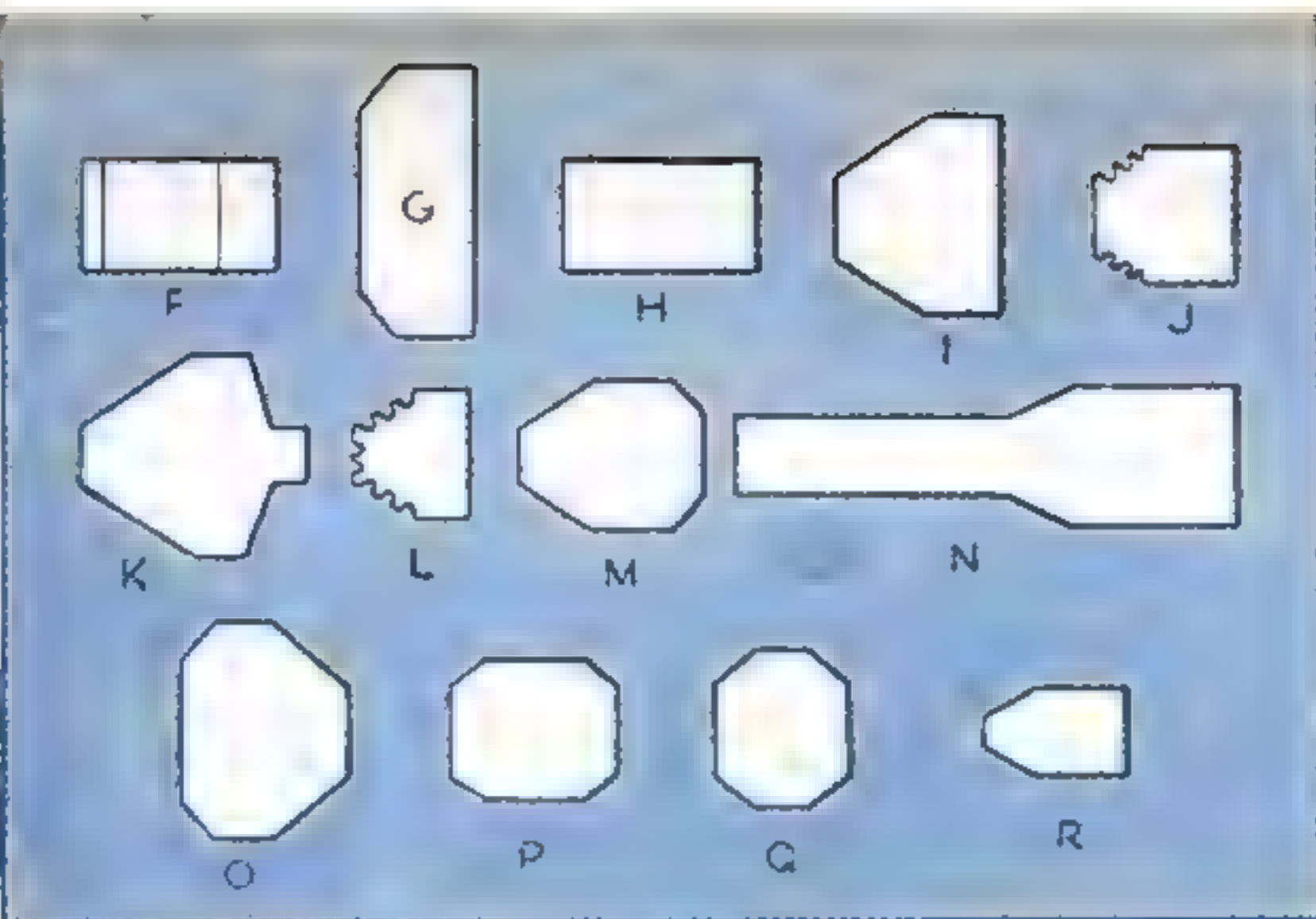
This fine example of table-top photography shows how realistic the little model looks in spite of its simplified construction

WE CONTINUE our series of American warship models with the U.S.S. *Philadelphia*—the first of a new class of eleven light cruisers to join the fleet. The most novel feature in the design of these ships is a hangar included in the hull that can accommodate eight planes. It is fitted with an elevator to lift the planes to deck level, where they are placed on catapults by a crane located at the stern. Also unique is the mounting of three gun turrets forward.

With their high freeboard and unbroken sweep of deck, these ships appear huge in contrast with the previous light cruisers of the *Omaha* class. Their dimensions: length, 600'; beam, 61½'; draft, 19¾'; armament, fifteen 6" guns in five triple turrets and eight 5" antiaircraft guns; horsepower, 100,000; designed speed, 32½ knots.

Our model is built to our usual scale of 1" equals 100'; however, the

The hull, made in two sections, is not glued up until it is painted



Full-size drawings of all the parts not clearly shown on the plans below. See the list for the thicknesses

drawings are sufficiently detailed to enable anyone so desiring to build a double-size model.

The construction is very simple. Since the plans are reproduced full size, it is unnecessary to give dimensions. The wedge *C* gives the hull its sheer. This, together with *D*, should be glued to *B* before shaping the hull.

In building a full-hull model, it is advisable to hold parts *A* and *B* together with wooden pegs while the shaping and construction progress. Prior to painting, they can be separated and *A* painted black while *B* and the superstructure are painted battleship gray.

The turret guns are made of thin wire. They must be mounted evenly and absolutely parallel to the center line of the ship. The antiaircraft guns are short pieces of wire inserted through tiny beads glued to the deck.

The searchlights and platforms are ball-headed pins set in cardboard strips.

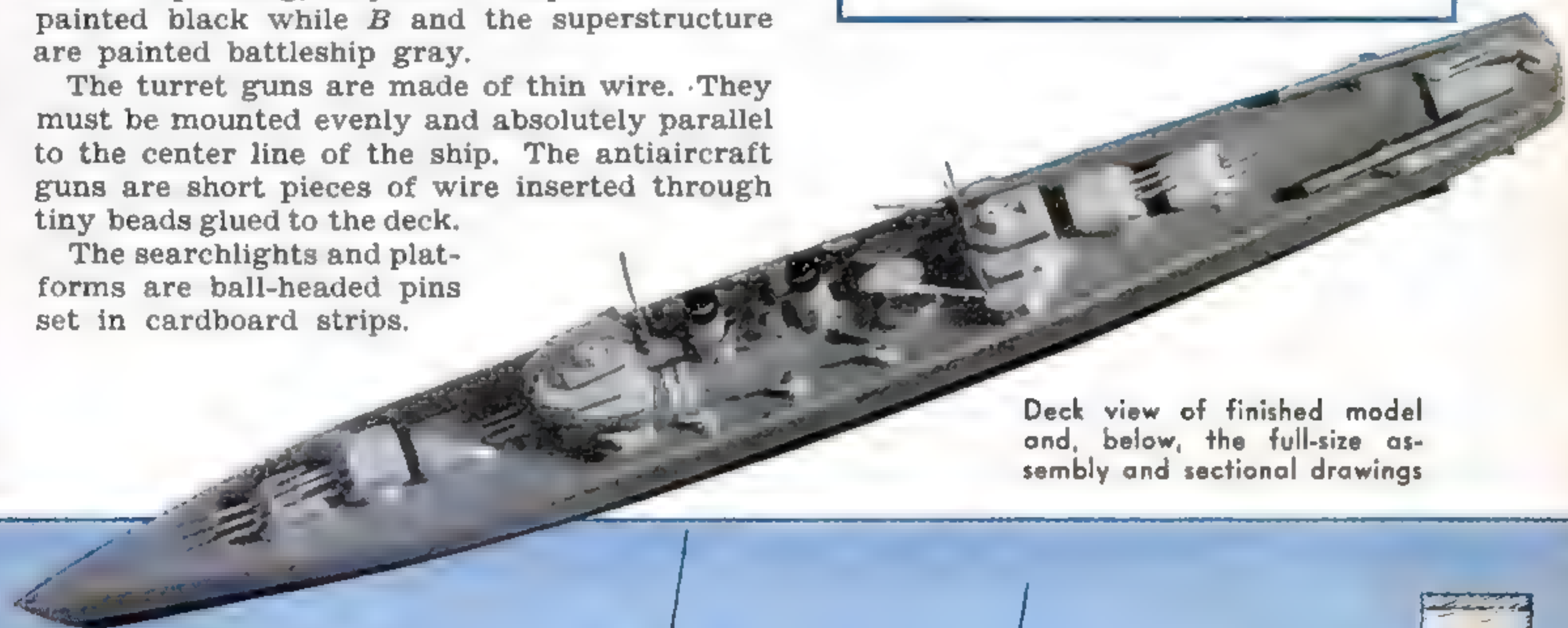
LIST OF MATERIALS

WHITE PINE, BASSWOOD, OR
BALSA

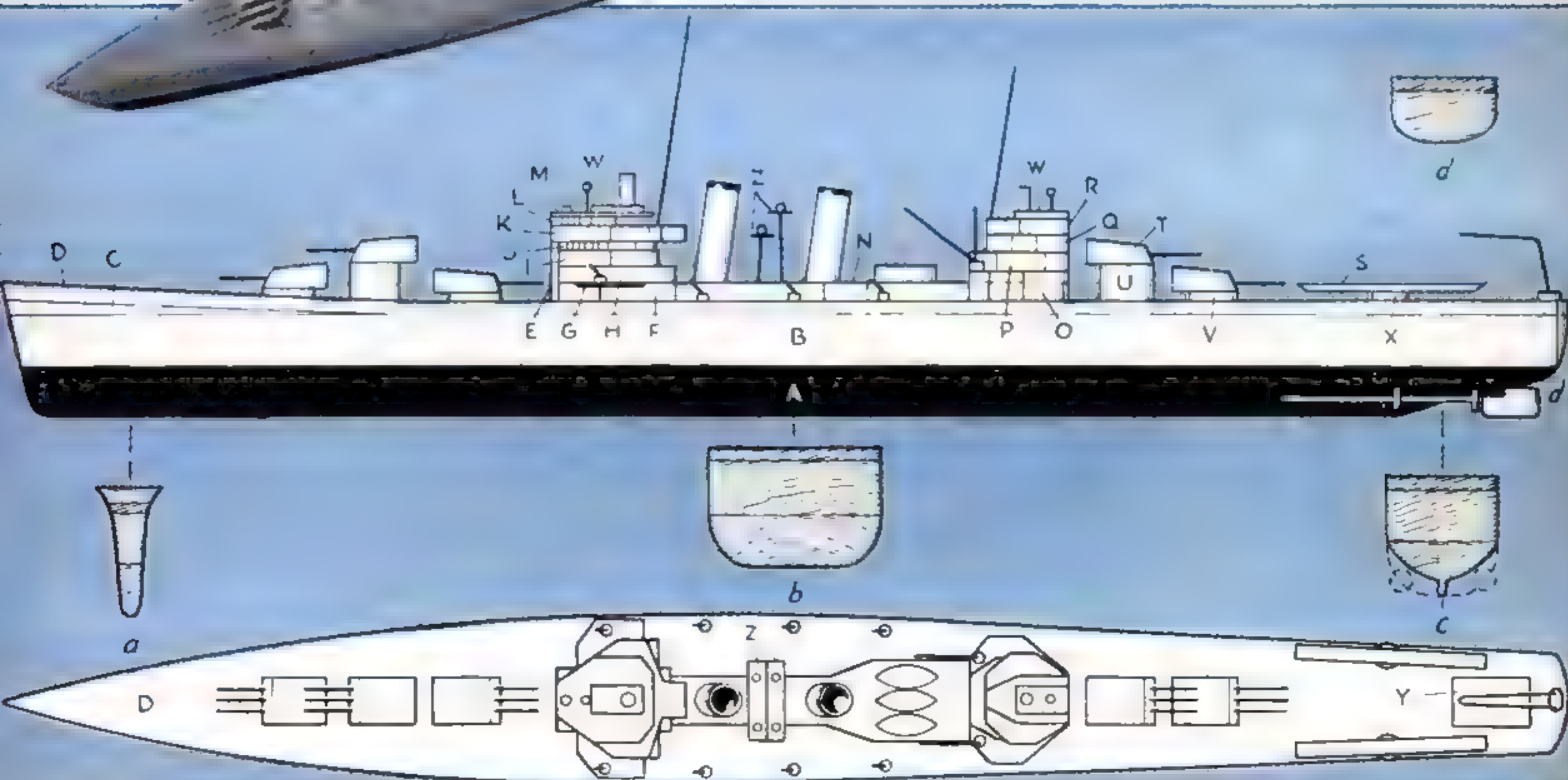
No. Pc.	T.	W.	L.	For
2	3/16	5/8	6	A and B
3	1/16	5/8	6	C, D, F, H, I, K, N, O, P, Q, R, and 3 boats
1	1/32	5/8	6	E, J, L, O, S, V, W, X
1	3/16	3/32	2	T
1	3/8 round		2	Funnels
1	3/16 "		1	U

MISCELLANEOUS

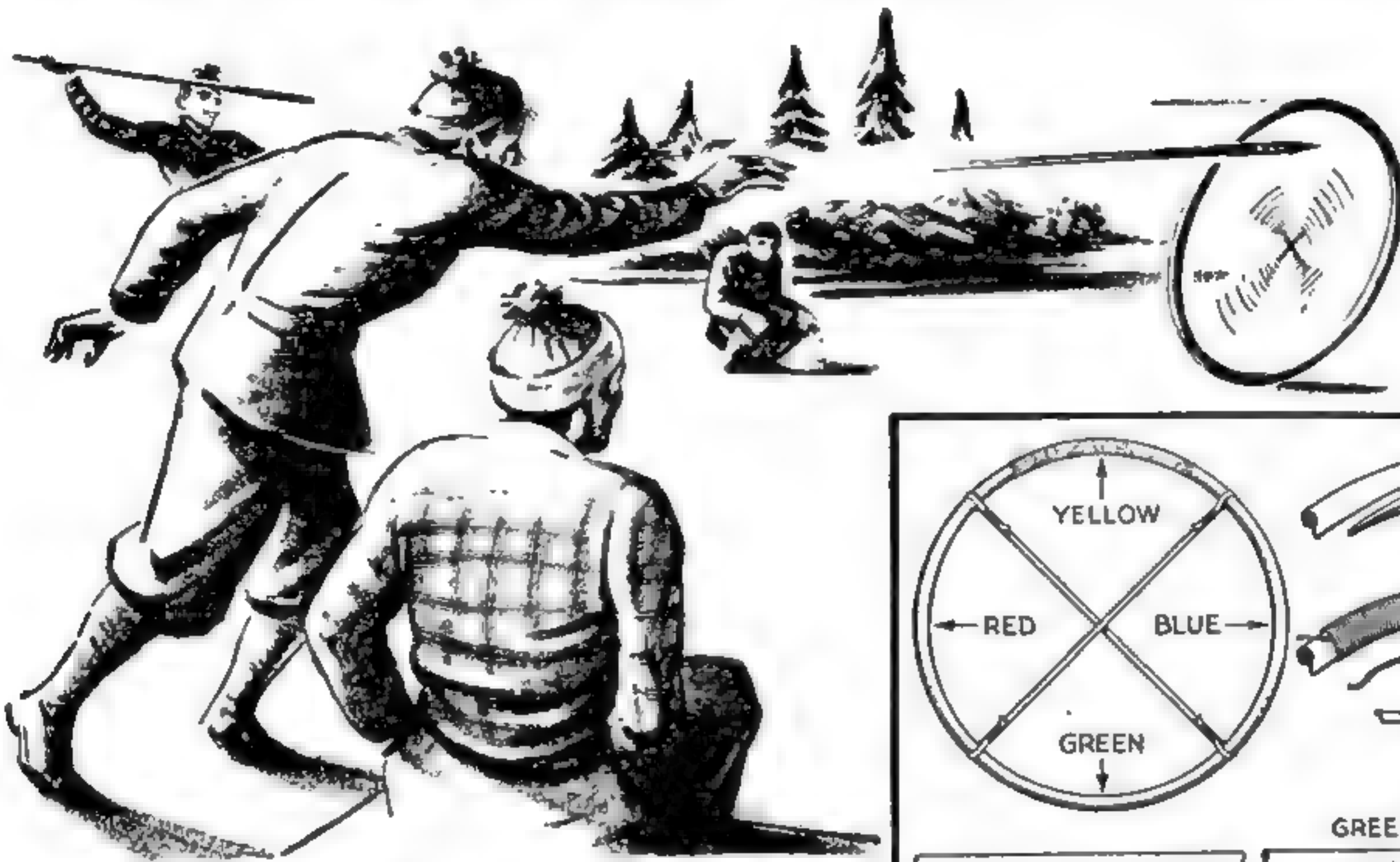
- 1 small piece cardboard for G, M, Y, Z, and rudder.
- 4 ordinary 3/4" pins for screws (propellers)
- 8 butterfly-mounting (roundheaded) pins for searchlights, masts, etc.
- 12 small beads for antiaircraft gun bases, etc.
- 2' thin stiff wire for guns, cranes, etc.
- Gray and black paint; glue or cement.



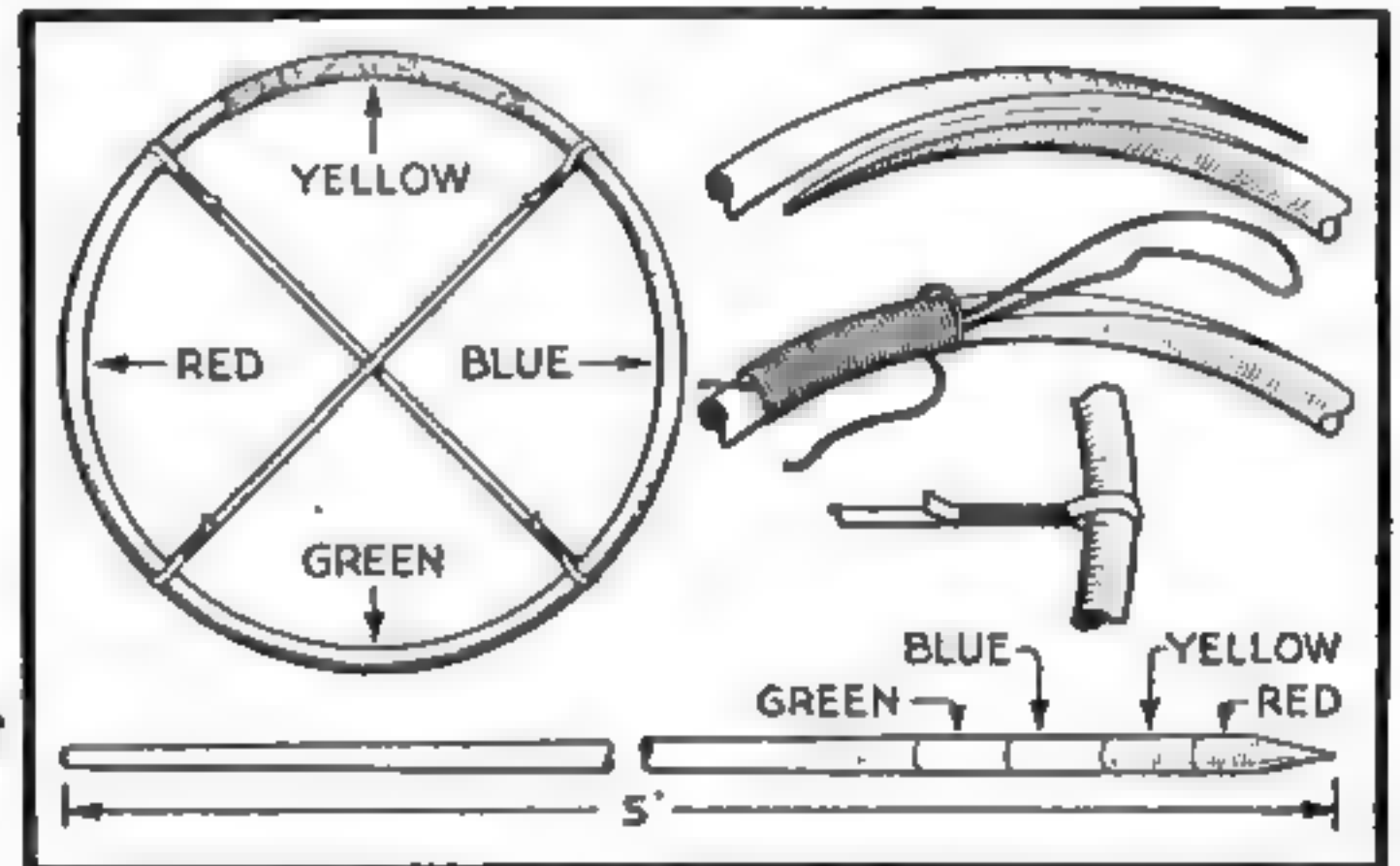
Deck view of finished model and, below, the full-size assembly and sectional drawings



Indian Hoop-and-Spear Game Gives Exciting Sport



The game may be played on smooth, hard snow, on ice (with or without skates), or on level ground. The object is to stop the hoop rolling



OF INDIAN origin, this fast hoop-and-spear game gives exciting sport for two individuals or two teams. One very large hoop is made as shown from one or more peeled and pliable willow branches about $\frac{1}{2}$ " in diameter. It is divided into four equal parts with strong cord or rawhide, and each quarter of the hoop is painted a different color. Each player requires a 5' wooden spear tapering from $\frac{3}{4}$ " to 1" in diameter and having a point at the thicker end. Four bands of color, each 6" long, are painted at the end.

The player who carries the hoop rolls it, at a given signal. As it hits the ground, both

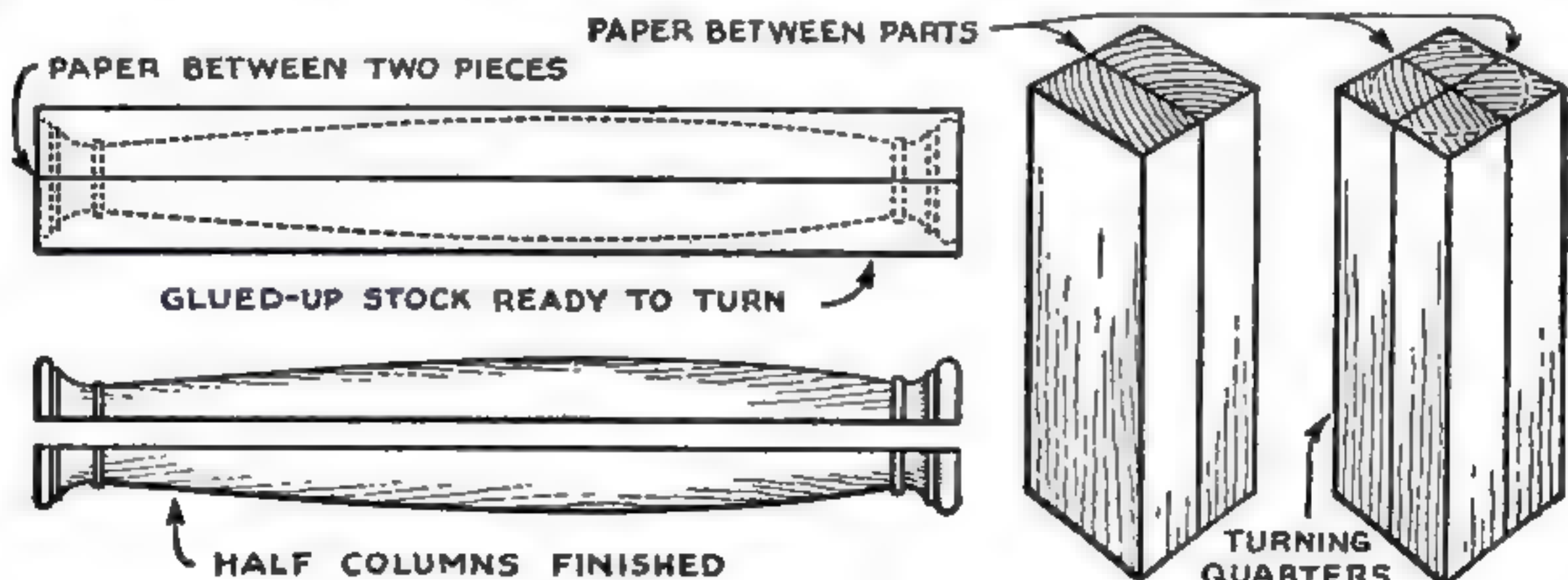
players try to stop it by throwing the spears through it. On both hoop and spear, red counts 10, yellow 5, blue 3, and green 1. If the red tip of the spear and the red part of the hoop touch, for example, the player scores 20. If the spear goes through so far that no color touches the hoop, then only the color on the hoop is counted. The player having the highest score rolls next. If both miss the hoop, the one whose spear came closest has it for the next roll. The limit in points is usually 50.—GRAY WOLF.

SPLIT TURNINGS

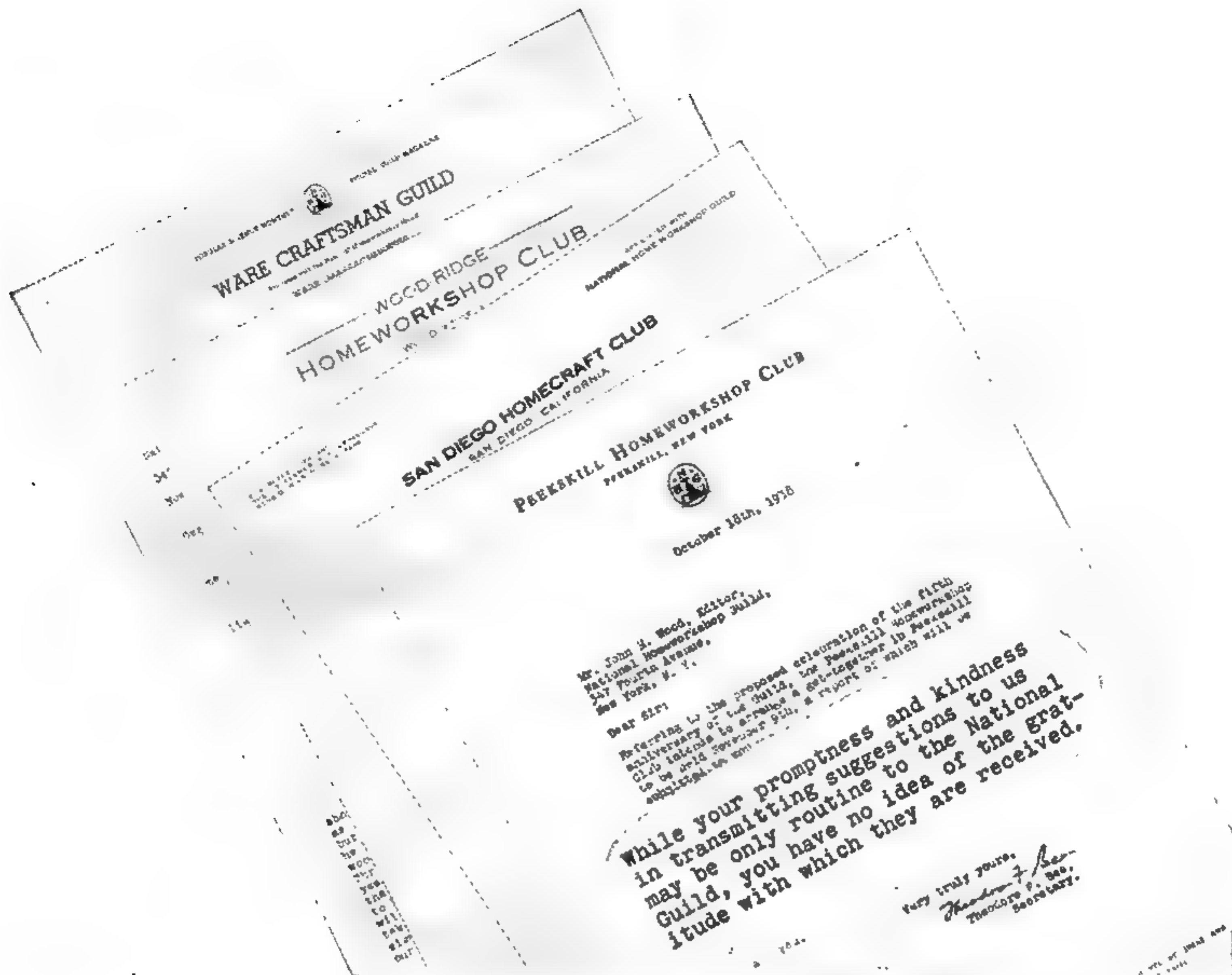
[WOODWORKING]

Split turnings are used to decorate flat surfaces on furniture. 1. Prepare two pieces of stock and glue together with paper between. 2. Turn as an ordinary spindle turning. 3. Drive a sharp chisel into the

joint from one end to split the paper. 4. Scrape and sand off the paper. (For quarter turnings, if required, glue up two pieces with paper between, then saw through and reglue with paper between to make a square as shown.)



POPULAR SCIENCE MONTHLY SHOP DATA FILE



Home Workshop Clubs

ACCLAIM GUILD'S FREE SERVICES

INCREASED membership in home workshop clubs throughout the United States and Canada has brought the total enrollment to a new high. Special bulletins and other services supplied free during the past year by the National Homeworkshop Guild are to a great extent responsible for this. Many letters of commendation have been received at the New York headquarters.

"Due to your helpful hints, we have been able to accept twenty-six new members and have prospects of many more," reports Dr. J. J. Stivenson, of the Popular Homeworkshop Club, *Waynesburg, Pa.*

"While your promptness and kindness in transmitting suggestions to us may be only routine to the National Guild, you have no idea of the gratitude with which they are received," Theodore F. Bee, of the *Peekskill (N.Y.) Homeworkshop Club*, wrote.

"Thanks to the National Homeworkshop

Guild's bulletins and other services, we are able continually to increase our membership and keep everybody interested," Albert Boutin, of the *Fall River (Mass.) Homecraft Club*, stated recently.

Inlaid pictures and veneering were discussed by the Tri-City Homeworkshop Club of *LaSalle, Oglesby, and Peru, Ill.*, at the home of Earl Gealow. At another meeting a demonstration of miniature gasoline motors was given by Paul Repka, assisted by R. Charles and Mr. Gealow. Several members are making duck decoys.

When L. J. Held spoke on uses of the slide rule before the Hardwood Homeworkshop Club, *Neenah, Wisc.*, so much interest was aroused that he agreed to give a series of ten short talks on the subject. To assist one of the members who is unable to work, the club held three "building bees" to help build a home for him.

As a result of a question box conducted by



Members of the Mount Vernon (N.Y.) Homecrafters recently enjoyed a jointer demonstration in the shop of John Stevenson



Board of governors of the Richmond (Va.) club in the basement shop of W. L. Gibbs

the *LeRoy* (N.Y.) Homeworkshop Club, a soldering demonstration was given by Charles Lupperger. Moving pictures on safety were shown by Guy Starkey at another meeting.

New officers of the Timbercraft Club, *New Bedford, Mass.*, are Charles Jeglinski, president and instructor; Adelard Richards, assistant instructor; Adolph Wiater, secretary-

local fire department, merchants, and various charity organizations assisted.

Women direct the affairs of the newly organized *Roanoke Rapids* (N.C.) Homeworkshop Club, although there are men members. Officers are Miss Christine Stewart, president; Mrs. Adeline Jernigan, vice president; Miss Wilma Edwards, secretary; Mrs.

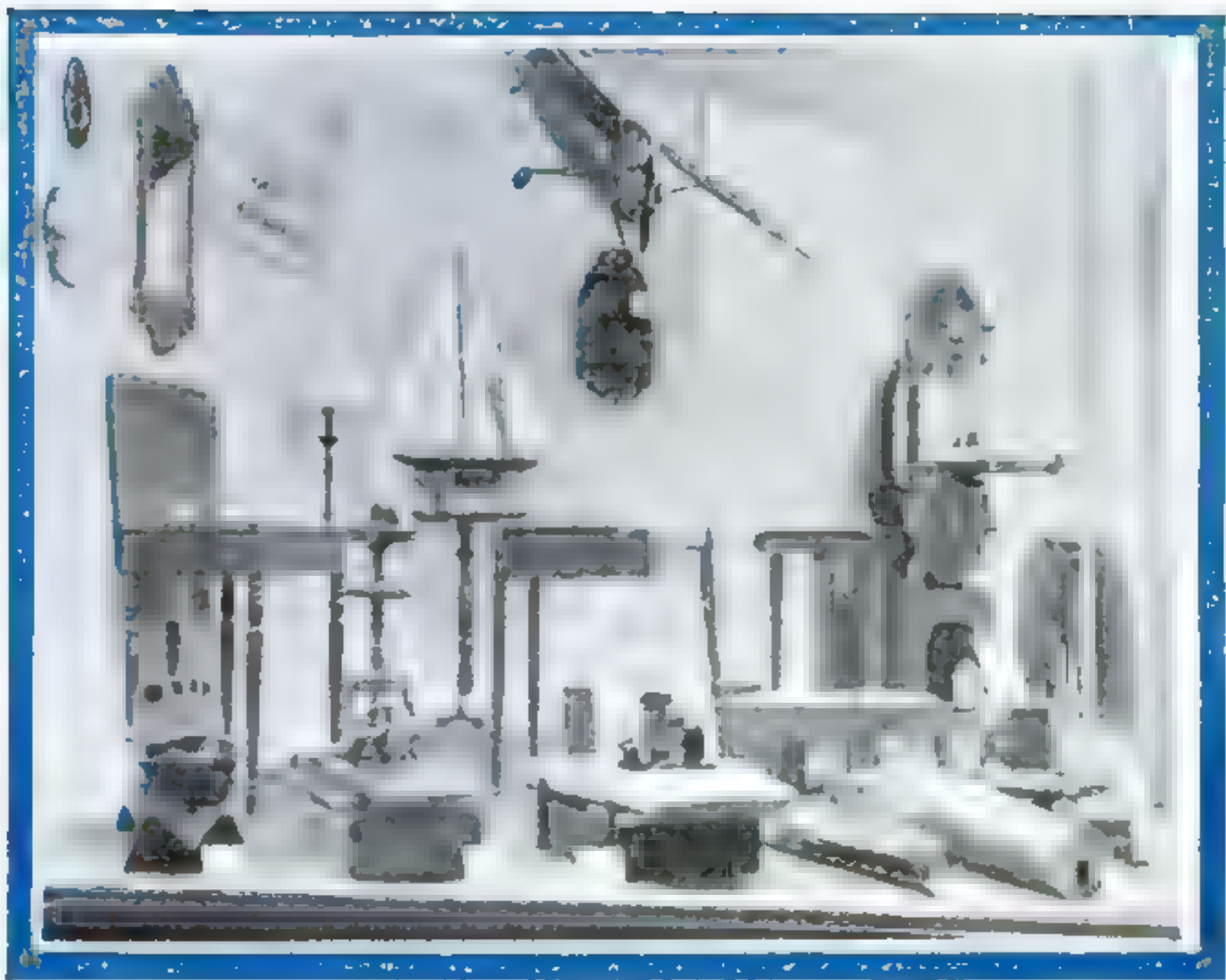
treasurer; Manuel Enos, librarian; Walter Modesto, tool man. In order to raise money for the purchase of club machinery, a number of sailboat shelves are to be constructed.

Although only a few months old, the *Lynn* (Mass.) Homeworkshop and Handicraft Club has established a clubroom and workshop, and was able to make and repair a large number of toys for poor children. The

Mary Garris, treasurer. Activities under way include painting gift cards, mending and painting toys for poor children, making pine-needle baskets, clay modeling, and working in copper.

Uses of a hand motor grinder were demonstrated before the Town Hall Homeworkshop Club, *Ottawa, Ill.* Philip C. Gaul spoke on pressed composition wood. . . Colored movies were shown to the *Topeka (Kans.)* Homeworkshop Club. . . Programs of the South Shore Homeworkshop Club, *Quincy, Mass.*, are planned three months in advance so that adequate publicity can be obtained. Demonstrations of wood turning and wood finishing, as well as moving pictures, were enjoyed at recent meetings.

Charles N. Ryan demonstrated how commercial kitchen cabinets are made at a meeting of the *Ware (Mass.)* Craftsman Guild. Secretary Stephen J. Milos has prepared a directory of concerns handling



Window display by the Richmond Homecraft and Modelmakers Guild

home workshop supplies. . . Uses of the metal working lathe were demonstrated by P. J. Schiemann before the *Denver (Colo.)* club.

YOUR PASSPORT TO BETTER CRAFTSMANSHIP

THOUSANDS of amateur craftsmen throughout the United States and Canada own membership cards similar to the one pictured below. Each card indicates that its owner belongs to a home workshop club—

that he meets with other craftsmen to discuss mutual shop problems, to hear valuable talks, to watch demonstrations, and the like. It is a "passport to better craftsmanship."

You, too, can obtain a "passport." There are undoubtedly at least five men in your neighborhood who, like yourself, would enjoy belonging to the National Homeworkshop Guild. All you have to do is to organize them into a club. Use the coupon below to obtain complete information.



National Homeworkshop Guild
347 Fourth Avenue, New York

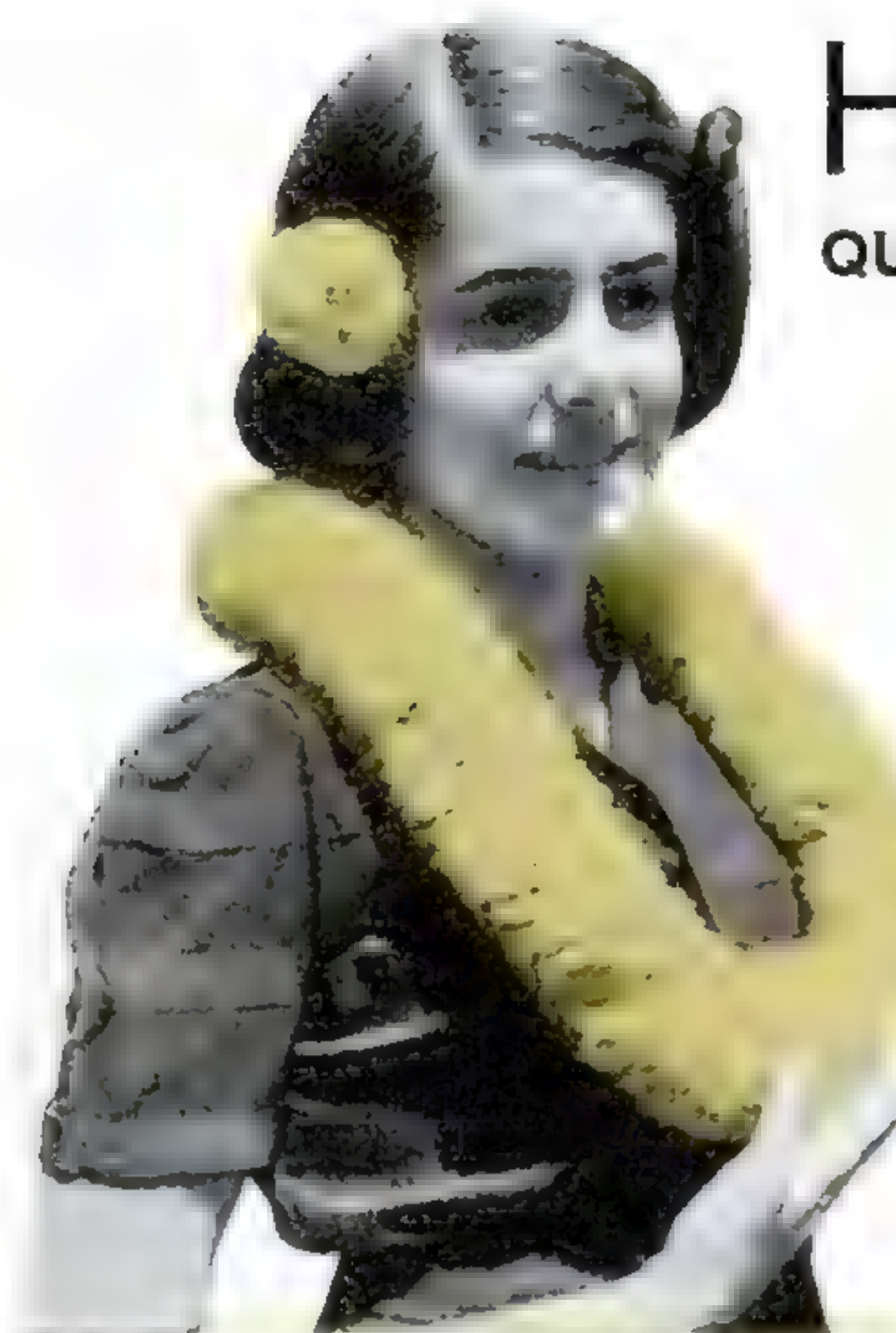
I want to start a home workshop club so that I can enjoy its fellowship and receive the many services furnished by the National Homeworkshop Guild. Please send me your special bulletin telling how to do this. For your use in mailing the information, I am inclosing a large (legal size), self-addressed, stamped envelope.

NAME

ADDRESS

CITY..... STATE.....
(Please print very clearly)

If your hobby is craftwork, you should have a card like this. Each Guild member receives one

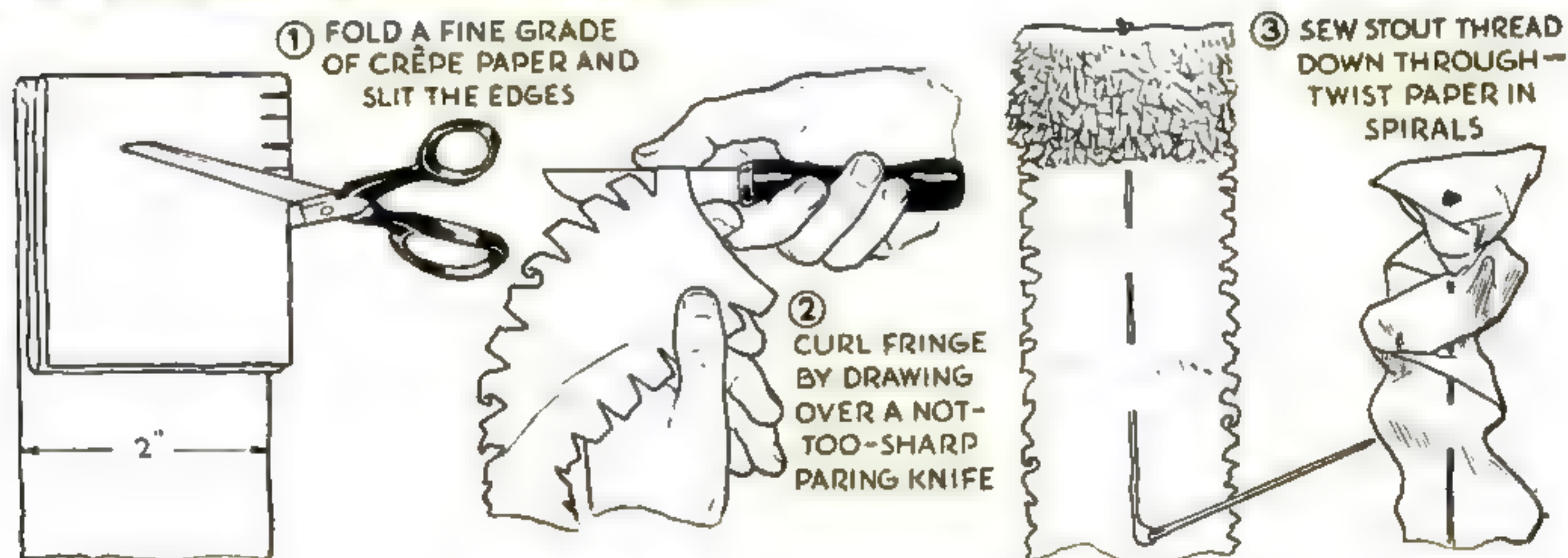


Hawaiian Leis

QUICKLY MADE FROM CRÊPE PAPER

THE romantic leis, or "Aloha wreath," with which natives bedeck departing friends at Honolulu, can be adapted to so many attractive uses that it is handy to know how to make them. They can be of practically any diameter, and the *crêpe* paper should be cut in strips of the desired width. Use the finer grade, in whatever shade suits your fancy. Lemon yellow is a favorite; and several colors may be used in a single wreath.

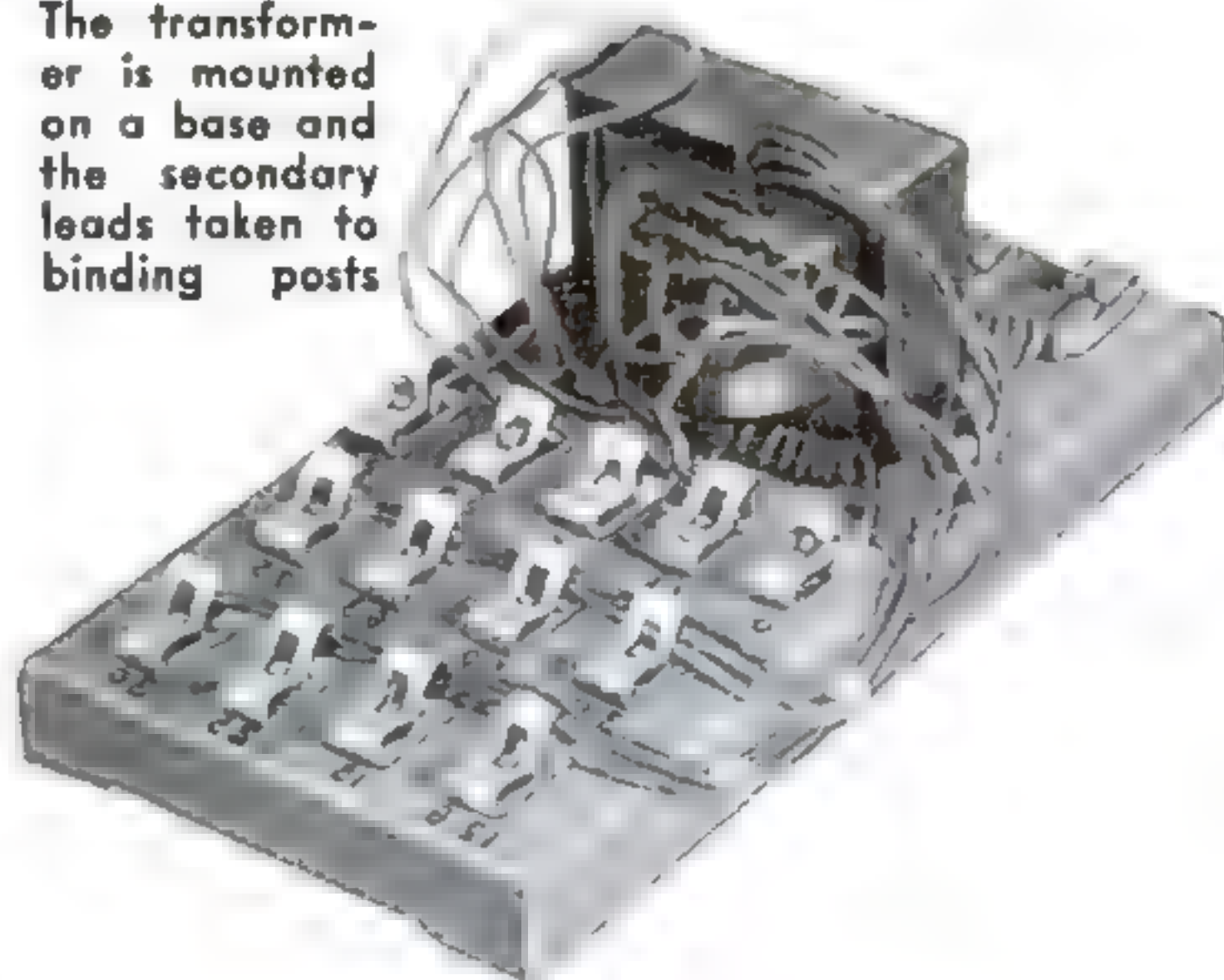
Fold the paper and slit the edges about $\frac{1}{4}$ " apart and $\frac{1}{2}$ " deep. Curl this fringe by drawing the paper over the blade of a rather dull paring knife. Now run a stout thread down through the paper as illustrated. As the paper is bunched up, give it a continuous twisting motion, so that it forms a spiral. The leis shown was made in this manner.—SUE BROWNE.



Tube-Testing Transformer Gives Many Voltages

VARYING alternating-current voltages for experimental purposes can be made conveniently available by using a radio tube-checking transformer. The transformer illustrated was purchased for about a dollar. It was merely set up on a baseboard, and the secondary leads were connected to binding posts. The transformer operates on from 110 to 125 volts, and the secondary leads provide voltages from 1.1 to 30.—R. W.

The transformer is mounted on a base and the secondary leads taken to binding posts



Oiling Tools Kept in Damp Shop

POWER or hand tools kept in damp places may be protected from rust by applying light machine oil with an insect sprayer. This is quicker than using a rag to oil them.—H.S.T.

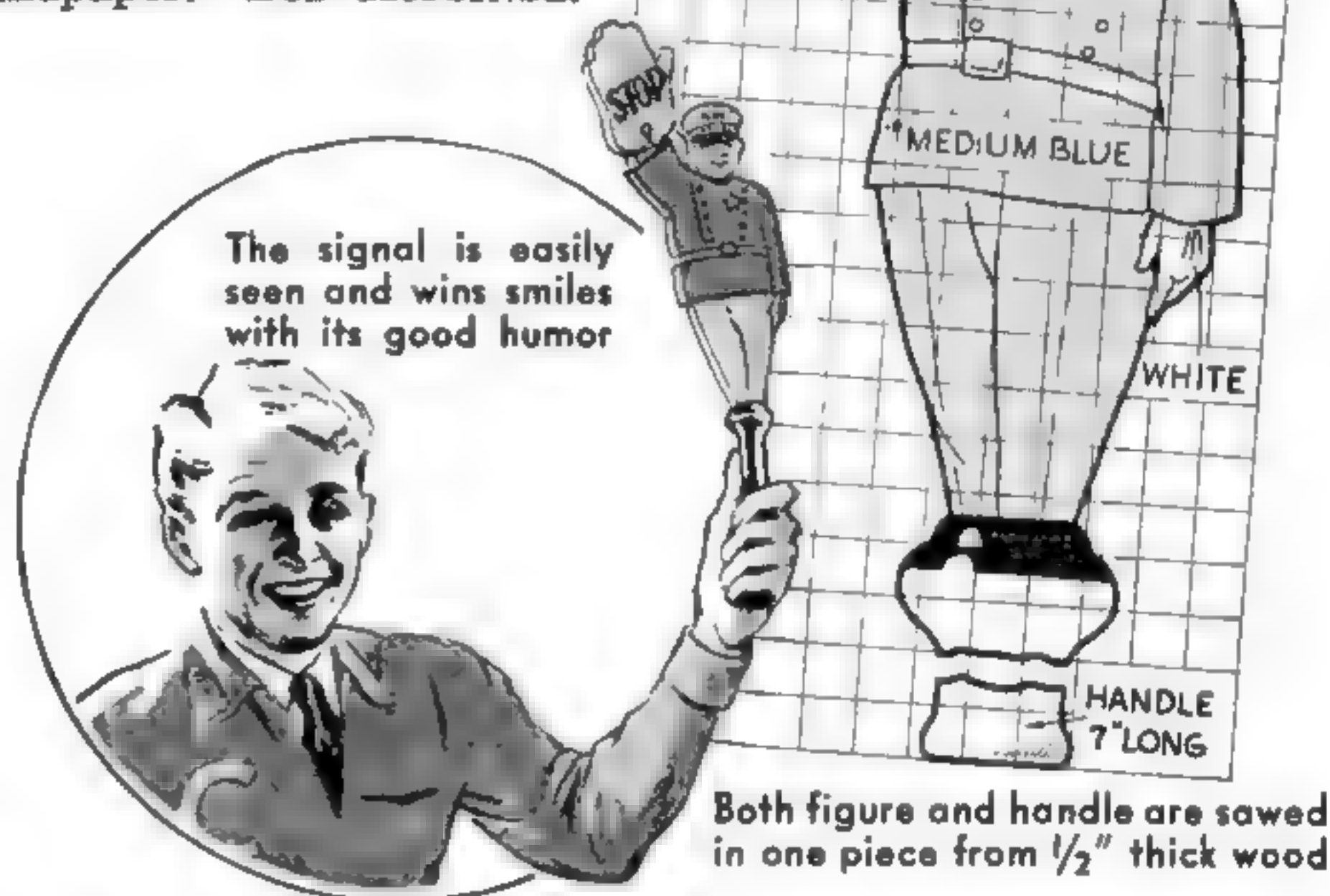


Tubing Insulates a Lamp Chain

FAULTY connections in bathroom lighting fixtures cause many accidents, especially where pull-chain sockets are used. If, through some defect, the chain becomes charged and a person grasps it while his other hand is in the water or touching the plumbing, he may even be electrocuted. To eliminate this hazard, slip a gum rubber tubing over the lower portion of the pull chain as illustrated above.—JOHN C. MICHALEK.

An Arresting Stop Signal for Use of Safety-Patrol Boys

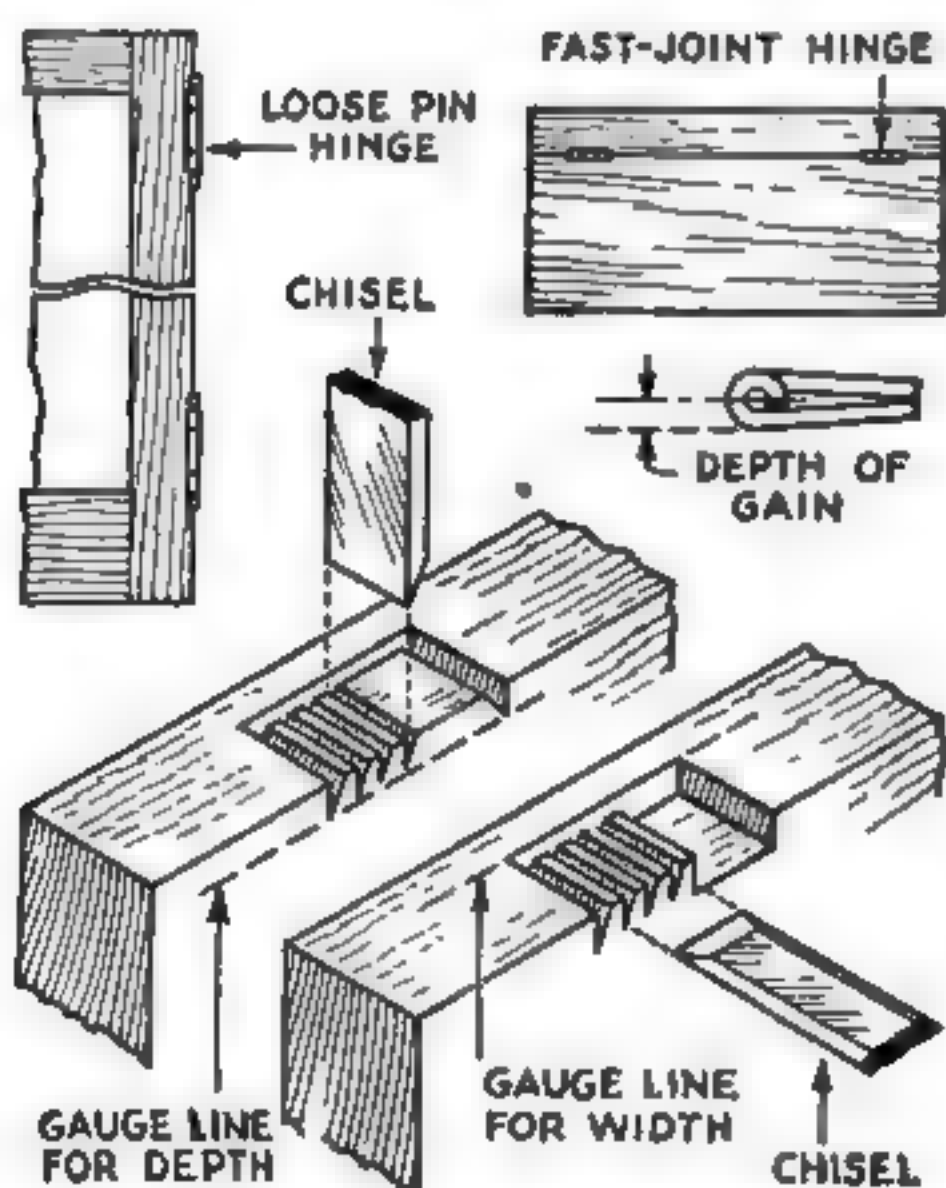
MOTORISTS approaching a school crossing will stop more cheerfully at the signal of a boy assigned to traffic duty by a school's safety patrol if he is provided with this amusing sign in the form of a policeman with upraised hand. Cut the figure from $\frac{1}{2}$ " thick wood, paint it on both sides, and apply a coat or two of varnish, except on the handle, which should be left plain. Round edges of handle with sandpaper.—BOB HOF SINDE.



Both figure and handle are sawed in one piece from $\frac{1}{2}$ " thick wood

HINGES FOR CABINET DOORS AND BOXES

[HARDWARE]



1. Mark length and width (less the knuckle) on both surfaces. (Door hinges are placed below the top rail and above the bottom rail; on a box, the distance between hinge and end of box usually equals length of hinge.)
2. Cut as shown to depth equal to half the thickness of the knuckle.
3. Fasten each leaf with one screw and try the fit.
4. Make any necessary correction and insert the other screws. If the recesses are made too deep, place cardboard beneath the hinges.

POPULAR SCIENCE MONTHLY SHOP DATA FILE



A back-stage view showing the general method of constructing the pieces pictured below and at right



The house is really a "flat" with painted door and window, but the bridge at left is more substantial

CDD-SHAPED stage pieces for specific purposes in amateur theatricals* are hardly ever used the second time. Each one is its own problem, and putting them together is a matter of individual ingenuity.

The small house shown in one of the photographs above gives a good example of special flat construction. Neither door nor window is "practical," both having been painted

*This is the second of two articles by Mr. Hall on making stage scenery for amateur productions.

on the covering and outlined with strips of wood. The shutter is pressed composition wood, nailed in place. A piece of 3" half-round molding covered with cloth is painted to resemble the tiles along the edge of the roof. Note the "broken" window pane, also done with paint.

With most sets, doors and windows are merely wooden frames fitted into openings in the flats. In the case of a small window, the frame is held in place against the flat by pins fitted through holes in the frame and

Amateur

HINTS ON GIVING THEM
A PROFESSIONAL LOOK •
DOORS, WINDOWS, AND
FOLDING PLATFORMS •
DISAPPEARING EFFECTS

Stage Sets

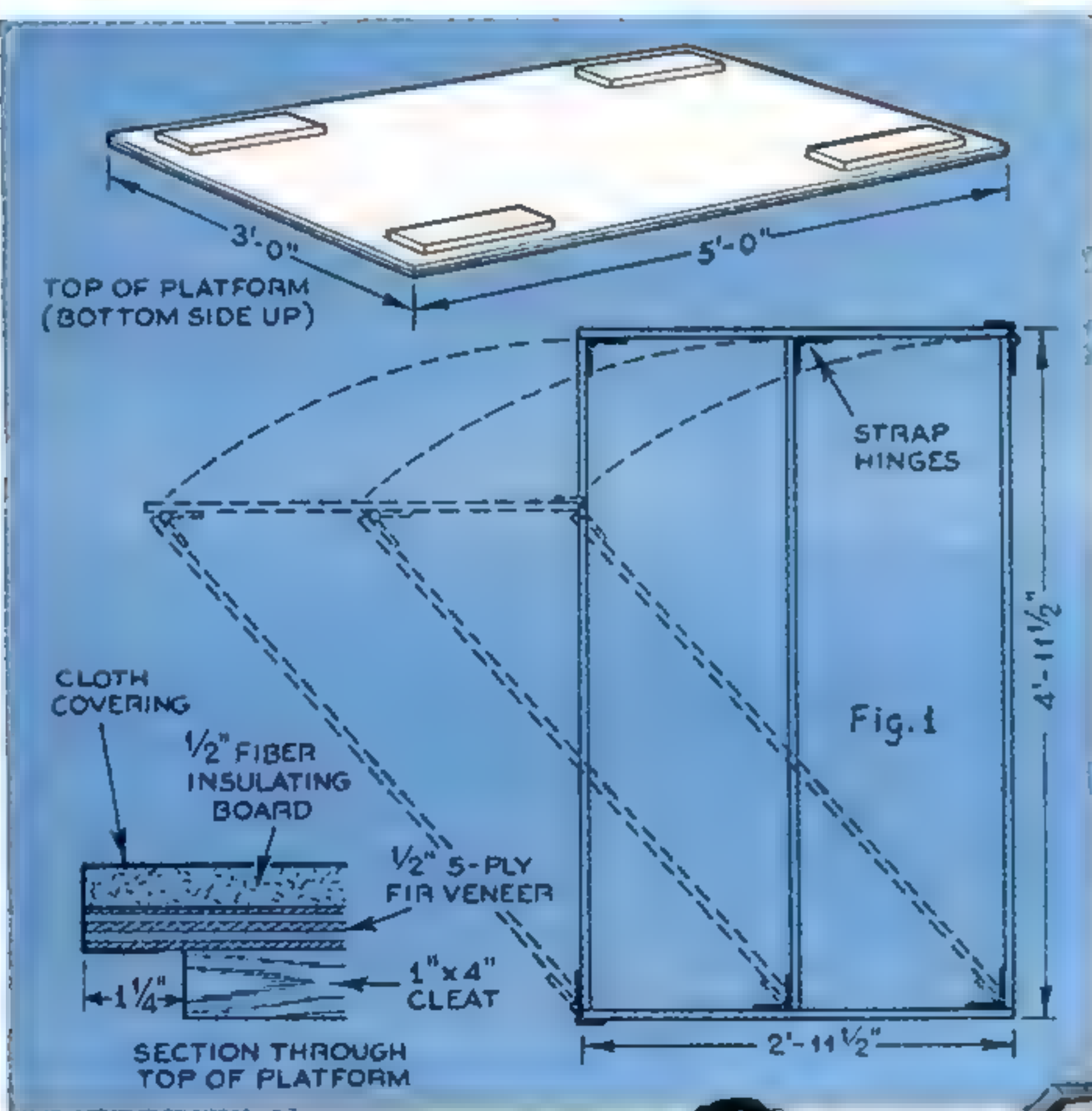
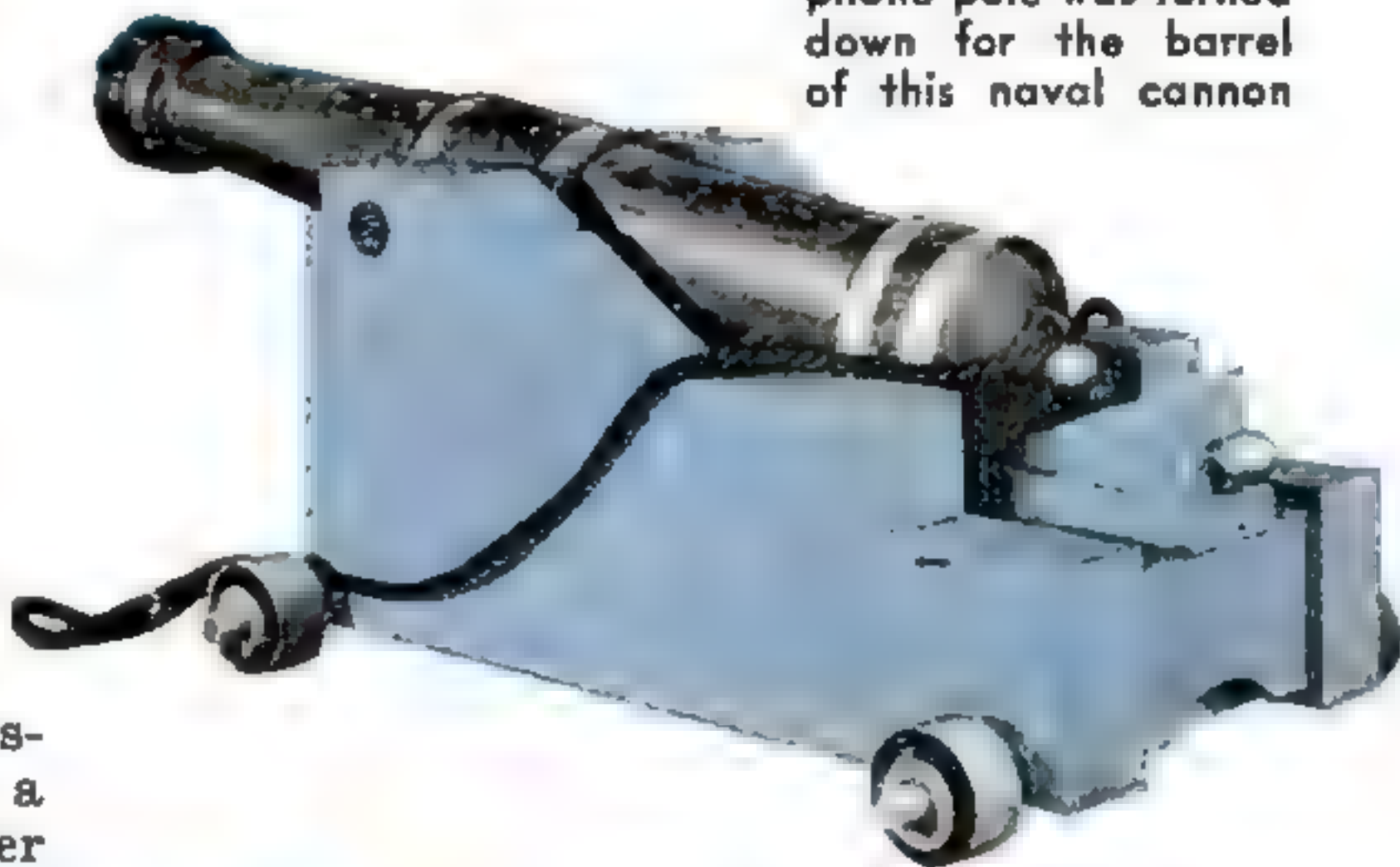
By
THOMAS L. HALL

bearing against the back of the flat. Doors are small flats hinged to the back of frames.

Never try to make a practical window with a sliding sash. If the coach must have one, buy it—weights and all.

Ordinary windows need not be covered if supposed to be transparent. Opaque windows are covered with cloth. Dirty windows are made by covering with clear, transparent wrapping tissue and spattering with a little sizing. The outlines of a stained-glass window may be cut from Bristol board and covered with colored transparent wrapping tissue. Water glass is a good adhesive, but never use it where water

Piece of an old telephone pole was turned down for the barrel of this naval cannon

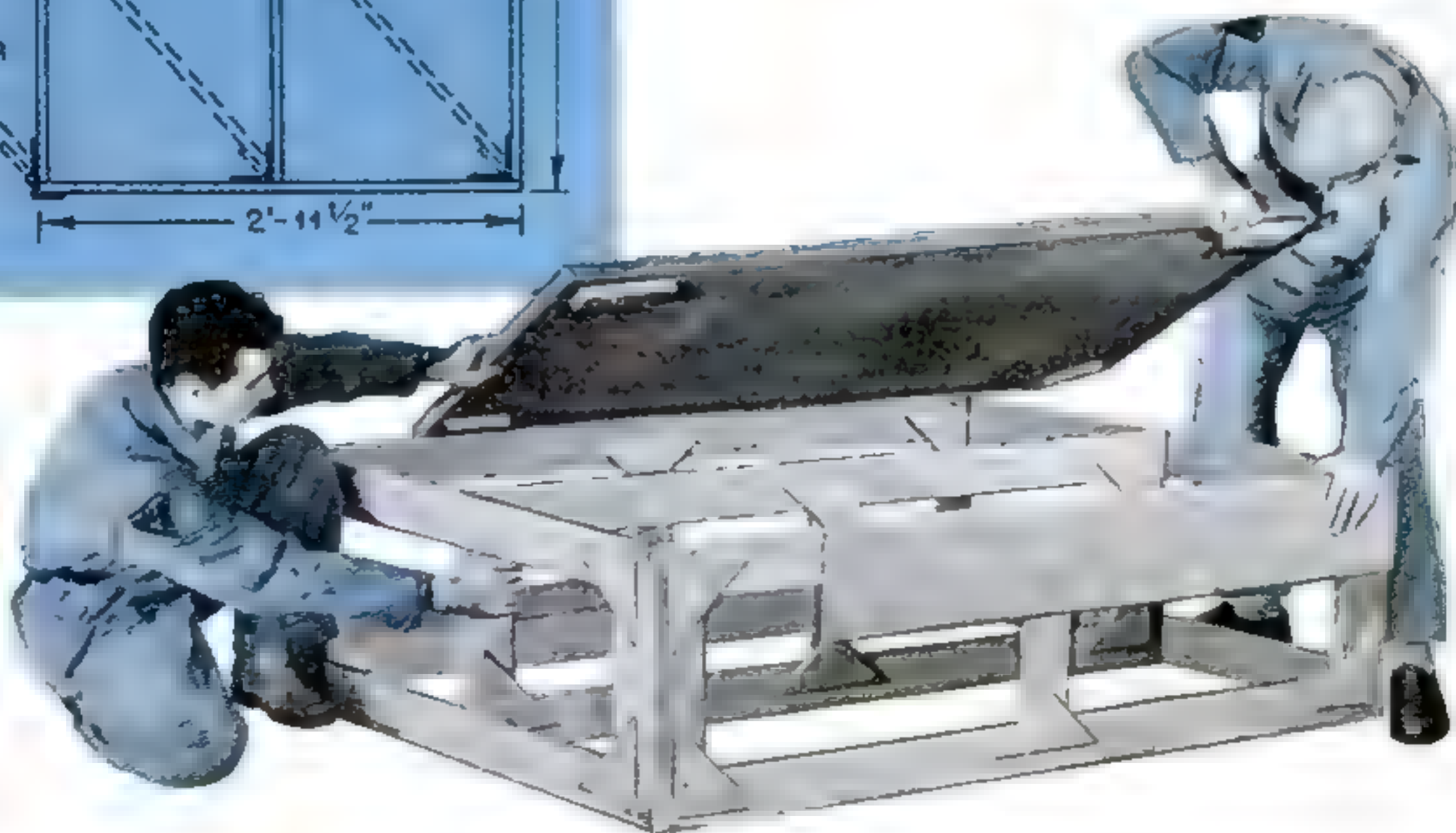


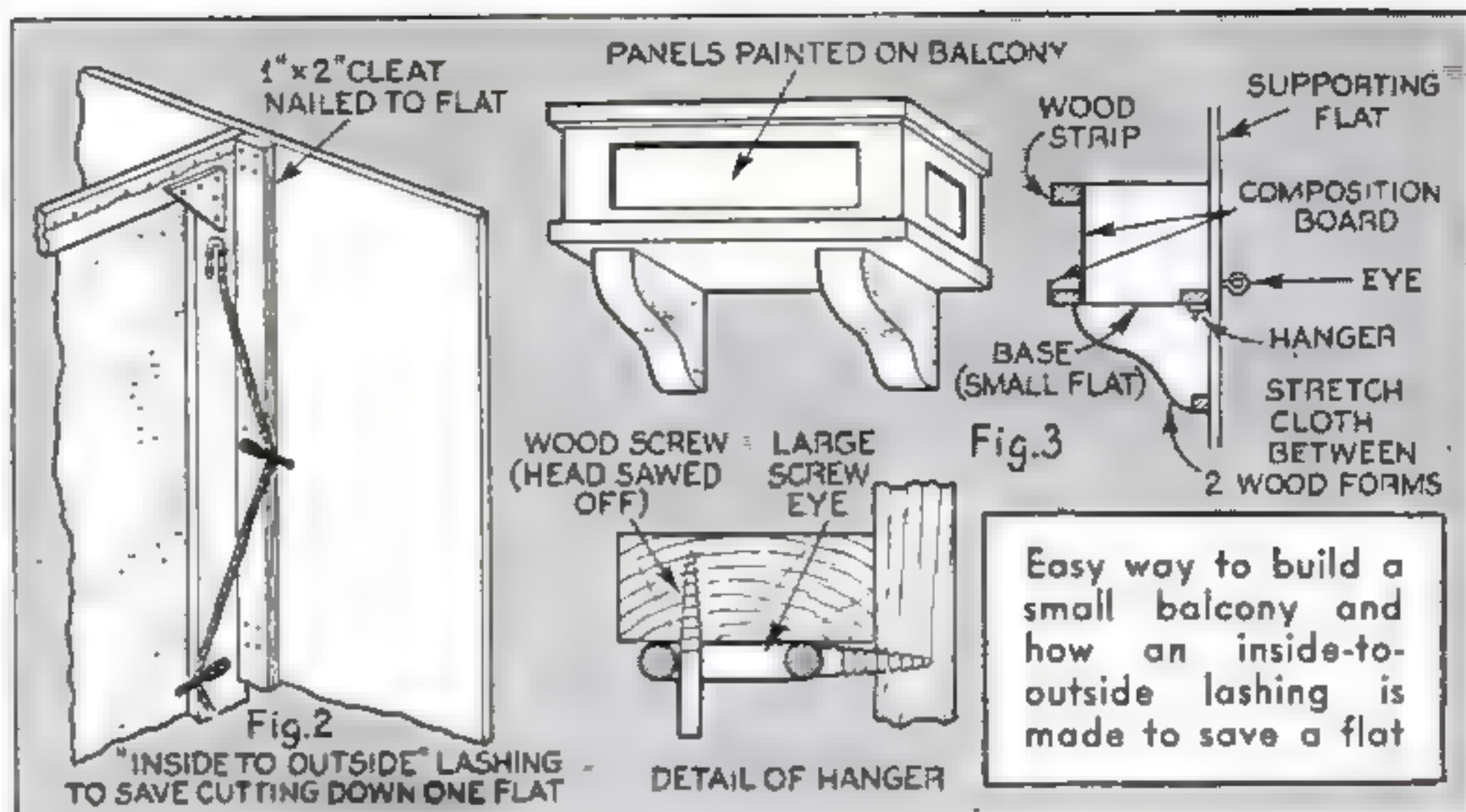
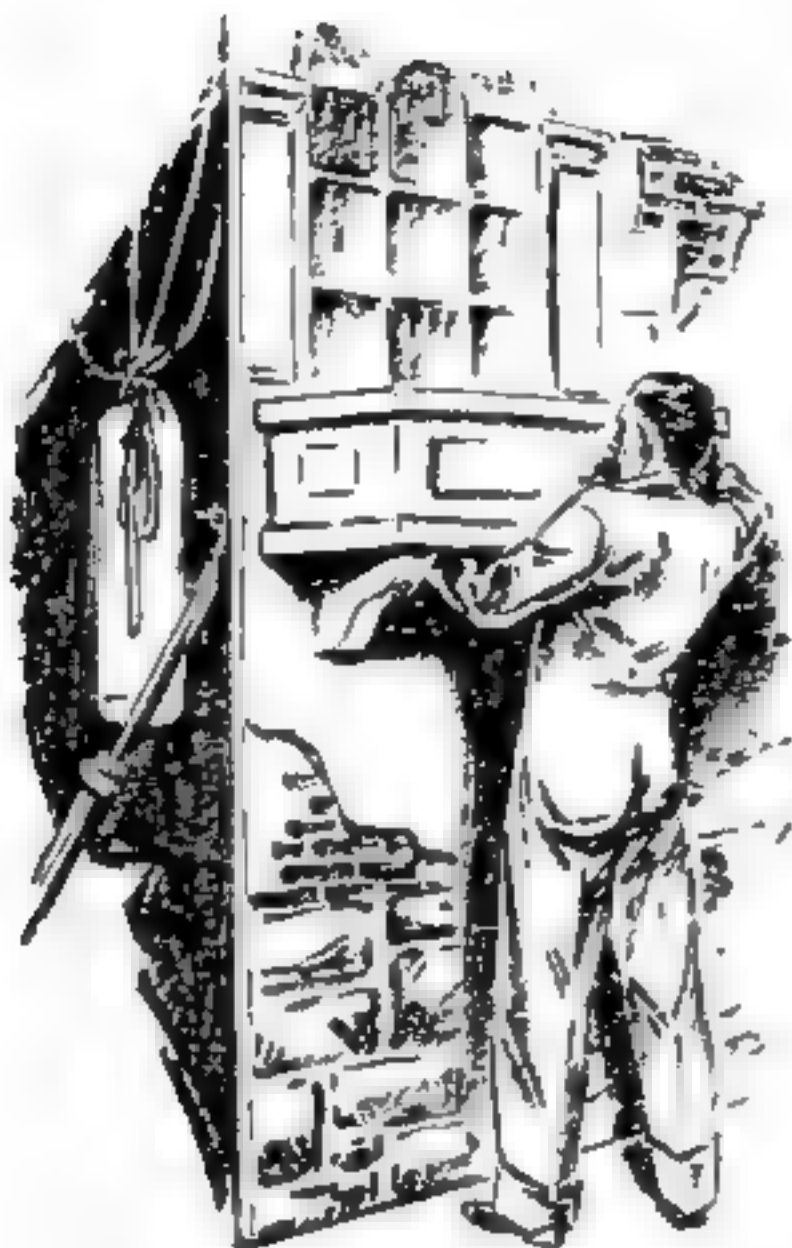
paint will be applied afterwards because it always shows through. When using the tissue, remember that although it has an excellent color when illuminated from behind, it cannot be used as a screen to cast color on another object. Regular gelatin color screens must be used for that purpose.

A window or other frame covered with theatrical gauze may be painted with an aniline color and will appear opaque when illuminated from the front. If lighted from behind, it will become invisible. Thus by changing the stage lighting, objects behind the screen can be made to appear or dis-

COLLAPSIBLE PLATFORM

Two amateur stage carpenters assemble a sturdy collapsible platform. The long, narrow masking piece of heavy cardboard was nailed on to fit the opening of an arch flat. How the platform frame folds is shown above





appear at will, as is sometimes required.

Light, collapsible platforms of a standard size are invaluable. With appropriate masking and profiles, they can be used for a variety of purposes such as bridges, rocky paths leading off-stage, and raised sections on stage. The most practical size is 3' by 5' by 22½" high (three steps), and the construction is shown in Fig. 1 as well as in a photograph. Masking in front of platform is built up of small flats, which are hooked to the platforms and steadied with short stage braces. Braces permanently hinged to scenery are usually

not desirable because they are too easily broken off. Small maskers of heavy cardboard or fiber board covered with canvas are good and can be nailed directly to the platforms.

Low walls are simply flats laid on the side with a broad reveal at the top. They are supported by short stage braces, or the backs can be boxed in and made self-supporting. (See illustrations of the "stone" bridge.)

Steps and stairs are best made in a fashion similar to ordinary house construction. They are heavy and cumbersome, so use them as

little as possible. Always hook them to the platforms to which they lead to avoid sliding when in use.

Other miscellaneous pieces are shown in photographs and Figs. 2 to 5. The small windmill is made of pressed composition wood and scraps of lumber, the round effect being obtained entirely by painting. It was set up in back of a profile and driven by a mechanism taken from an old electric phonograph motor. The lamp was made of pressed composition wood also, the post of scrap lumber.

Part of an old telephone pole was used for the marine cannon, ½" fir veneer for the sides of the carriage, and scraps of hardwood for the wheels and axles. You can usually get condemned telephone poles from the local telephone office or electric utility company.

On stage, a cylindrical object, unless carefully painted, looks flat; but a flat can be painted to appear cylindrical except at the edges. The best compromise, therefore, is to make tree trunks,

DISTANT WINDMILL

Front and back views of small working windmill for scenery in the distance. A lamp-post for a comedy sketch is shown at extreme left

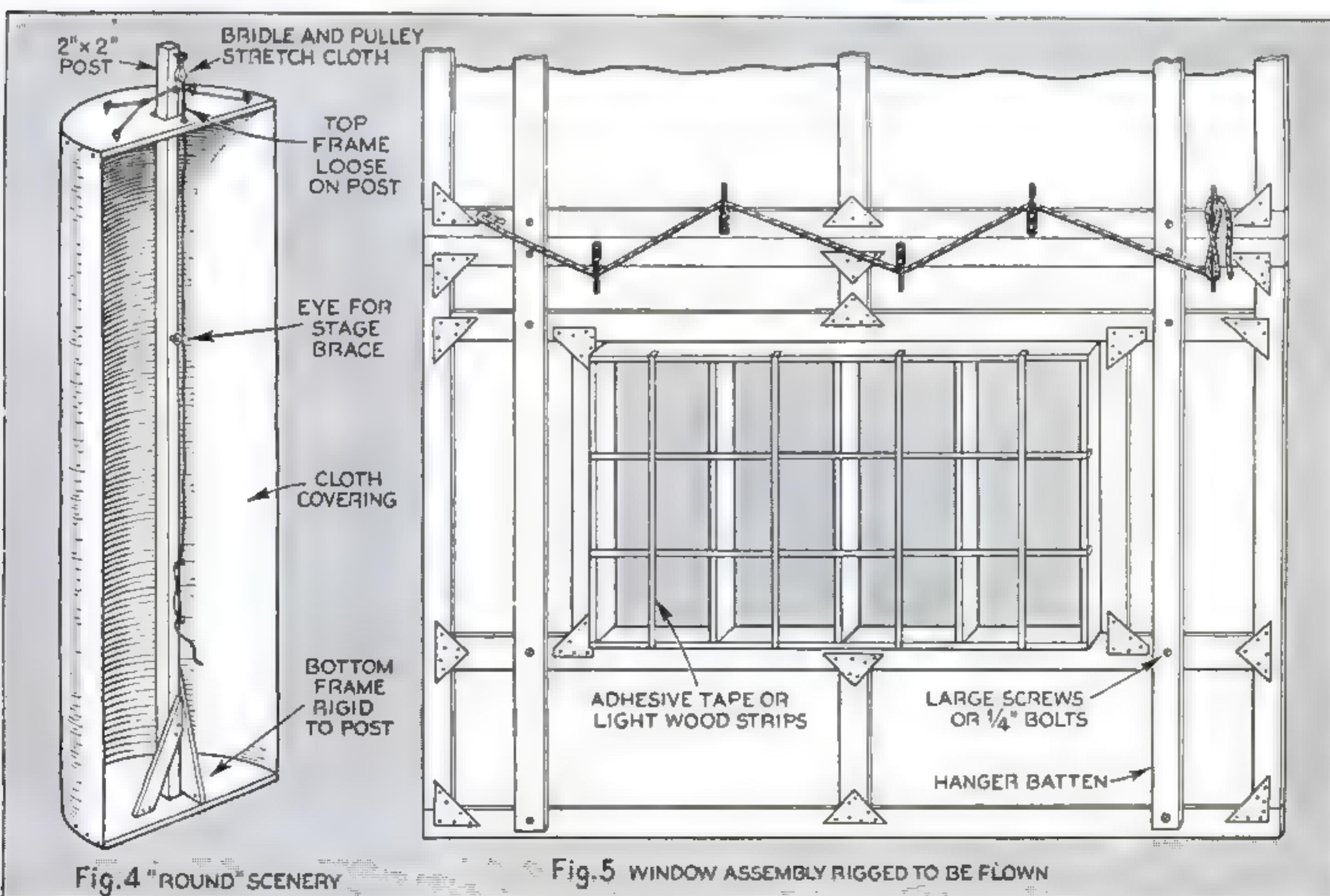


ship's masts, pillars, and the like a flat oval and let the painter make it look round. In most cases they must be made of heavy cardboard or thin fiber board and are a difficult, expensive job. They should be avoided as much as possible. Where rigidity is not necessary, they can be made as in Fig. 4. The top and bottom frames are elliptical and the cloth is painted to appear round from the audience.

When only part of a flat is needed, the arrangement shown in Fig. 2 often comes in handy and saves cutting down the flat. Nail a 1" by 2" cleat to the face of the flat to provide a surface against which the second flat can be lashed. Attach lash pins as indicated. The cleat can easily be removed later.

Always remember that the purpose of scenery is to create an illusion and never to reproduce an object exactly. Scenery should be light, easily handled, and, above all, strong.

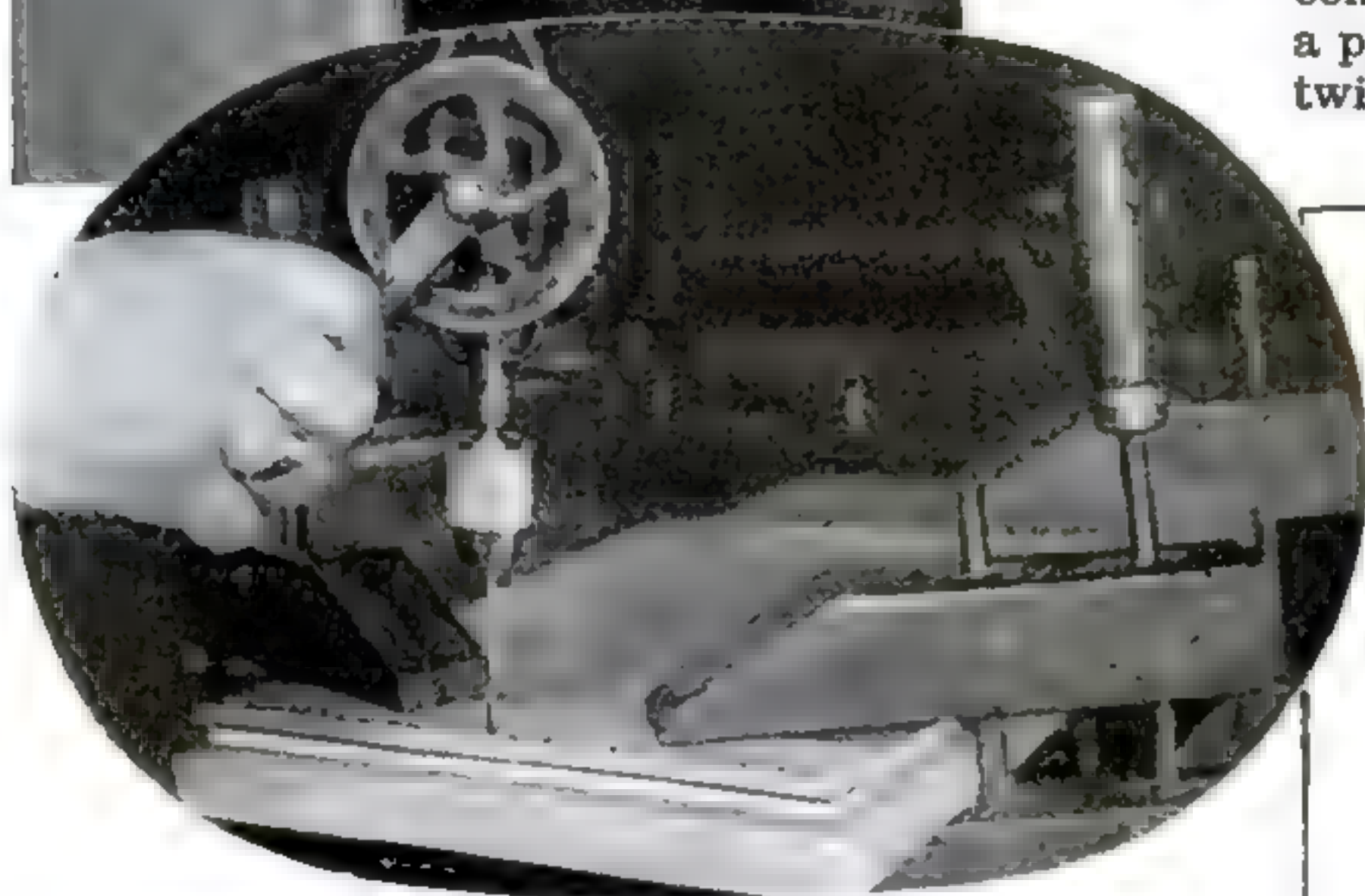
Putting the finishing touches on a large door frame. The lash pins near the right-hand edge are used to fasten frame to adjacent flats



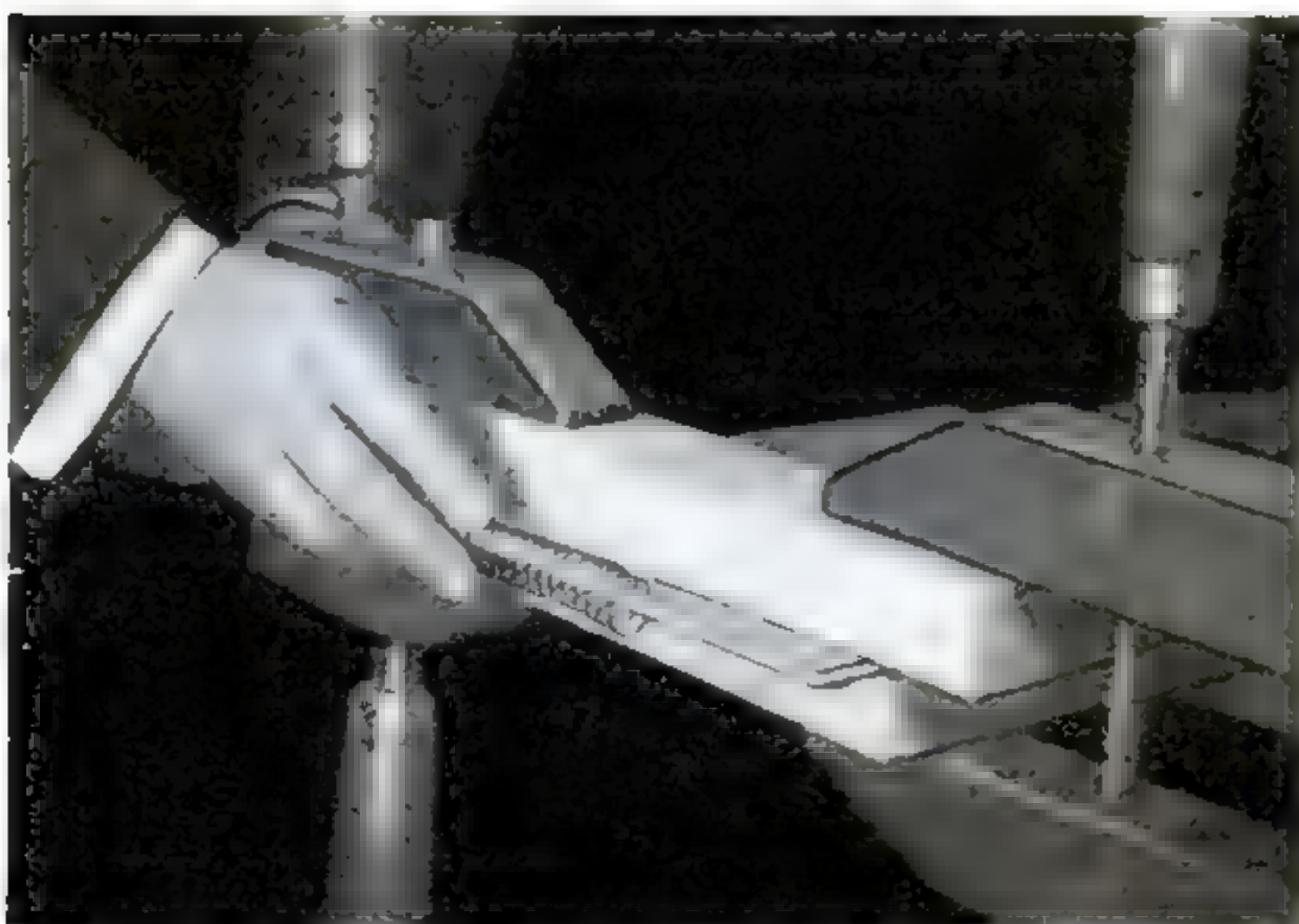


Odd-Sized Papers Neatly Bound with Old Notebook Coils

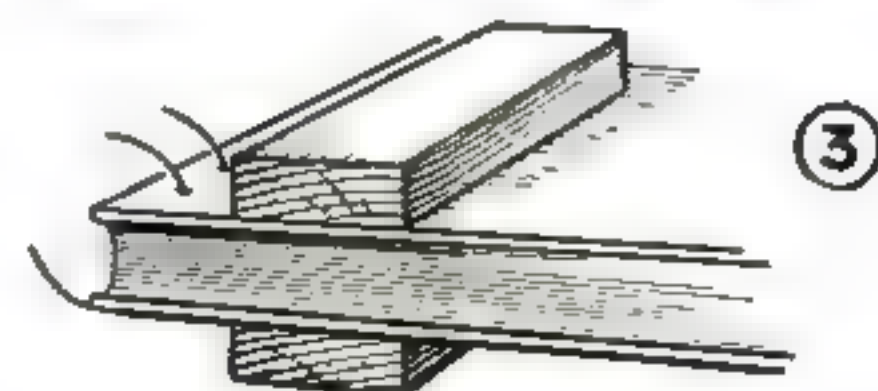
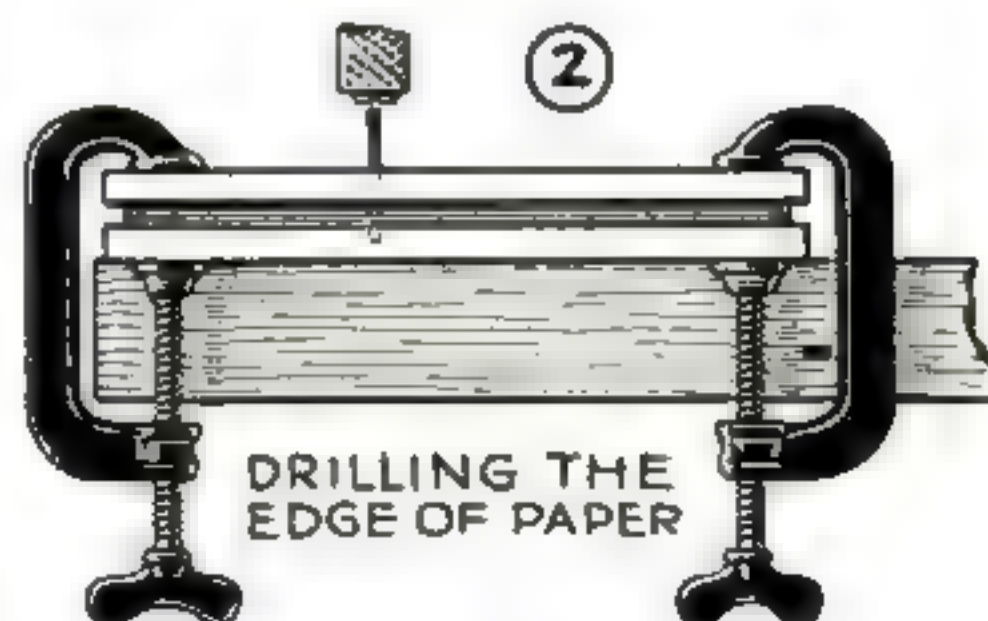
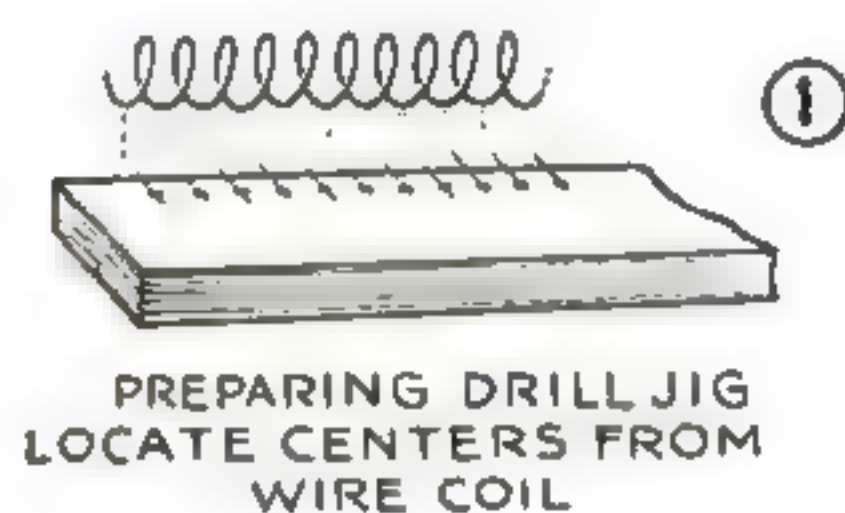
SPECIAL memorandum sheets, sets of mechanical drawings, and other odd-sized papers may be bound conveniently by making use of the wire coils from discarded spiral-bound notebooks. The holes in the paper will have to be accurately drilled, so it is necessary to mark a jig as shown in Fig. 1 and drill it, taking every precaution to insure perfect spacing. This guide is now set up for drilling the paper as in Fig. 2. In some cases, because of the clamps required, I have found it necessary to use a hand drill, but for larger work a drill press may be used, if available. Once the holes are properly drilled, it is easy to insert the wire coil. If the stack of papers is thick, insert a short piece of the coiled wire at each end so the edge can be clamped on a curve as in Fig. 3. When ready to bind the papers, remove the pieces of wire, insert the long coil, and bend the ends of the wire with a pair of pliers to prevent the coil from twisting out.—EDMUND C. HANLEY.

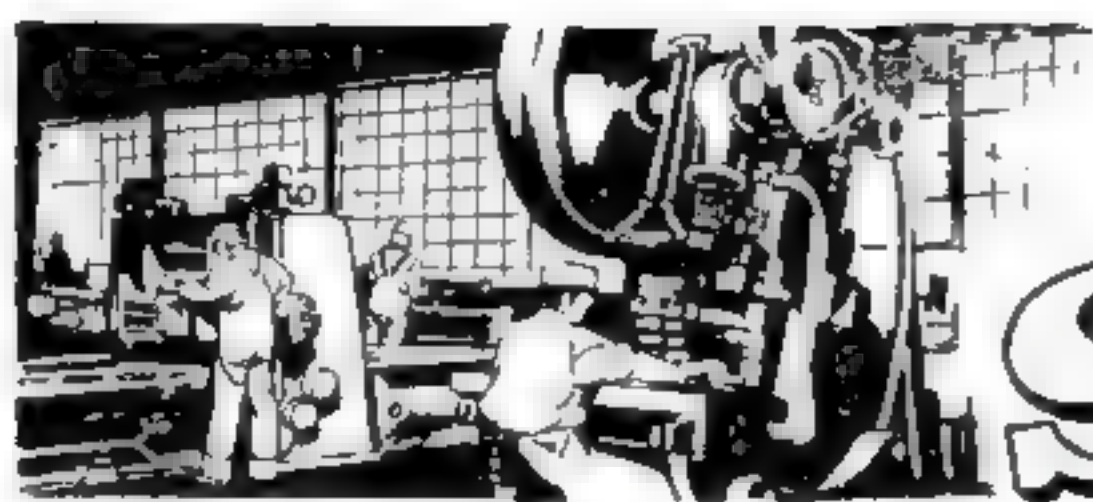


At top, the wooden jig is drilled so as to match the spacing of the wire coil. In oval, drilling the paper



Inserting the coil. If the stack of papers is thick, arrange the edge on a curve as shown in Fig. 3 at right





new SHOP IDEAS



Welded Arbor Press

FOR THE SMALL SHOP



Threaded sleeve, screw, bearing, and bottom plug. Above, assembled press



IF OXYACETYLENE-WELDING equipment is available, a small but powerful arbor press—an indispensable tool in any shop—can be constructed for a few dollars.

The screw is made from cold-rolled shafting as shown. Before it is threaded, one end is heated with the torch and upset so it may be recessed to hold the thrust bearing, which in this case is the spindle body bolt thrust for a model-A Ford. This thrust bearing is used so the screw will not have to turn on the work being pressed. The bearing is a tapping fit into the recess, and the bottom plug, turned from shafting, is a tapping fit into the bearing. The threaded sleeve for the screw is also made from shafting.

The handle consists of a disk to the center of which a nut is welded to fit the screw, and three pieces of pipe. The nut is welded to the disk first as it is fairly heavy; then the pipe handles can be added without burning the pipe away. It is advisable to lubricate the nut with a dab of graphite grease or lead paint so that it may be removed without scoring the threads.

Body and base are of $\frac{1}{2}$ " plate. The base 5" by 10", should be given a slight crown. The angle braces,

By W. C. CHENEY

while not essential, serve to reënforce the base.

Welding the base requires a No. 5 tip and 3/16" filler rod. The body is propped in place, and the torch is passed back and forth over the seam until the metal shows a blue or purple color. The weld is then started at one end and continued for about 1 1/2". The torch is moved to the opposite side, and an equal weld is made there. Return to the first side and repeat the process until the seam is completed.

It is important not to let the flame be reflected back onto the tip. At frequent

intervals turn out the torch and dip the tip into a bucket of water. This takes but a minute and may save the tip. If the angle braces are used, weld them on the outside first; then run the inside seams.

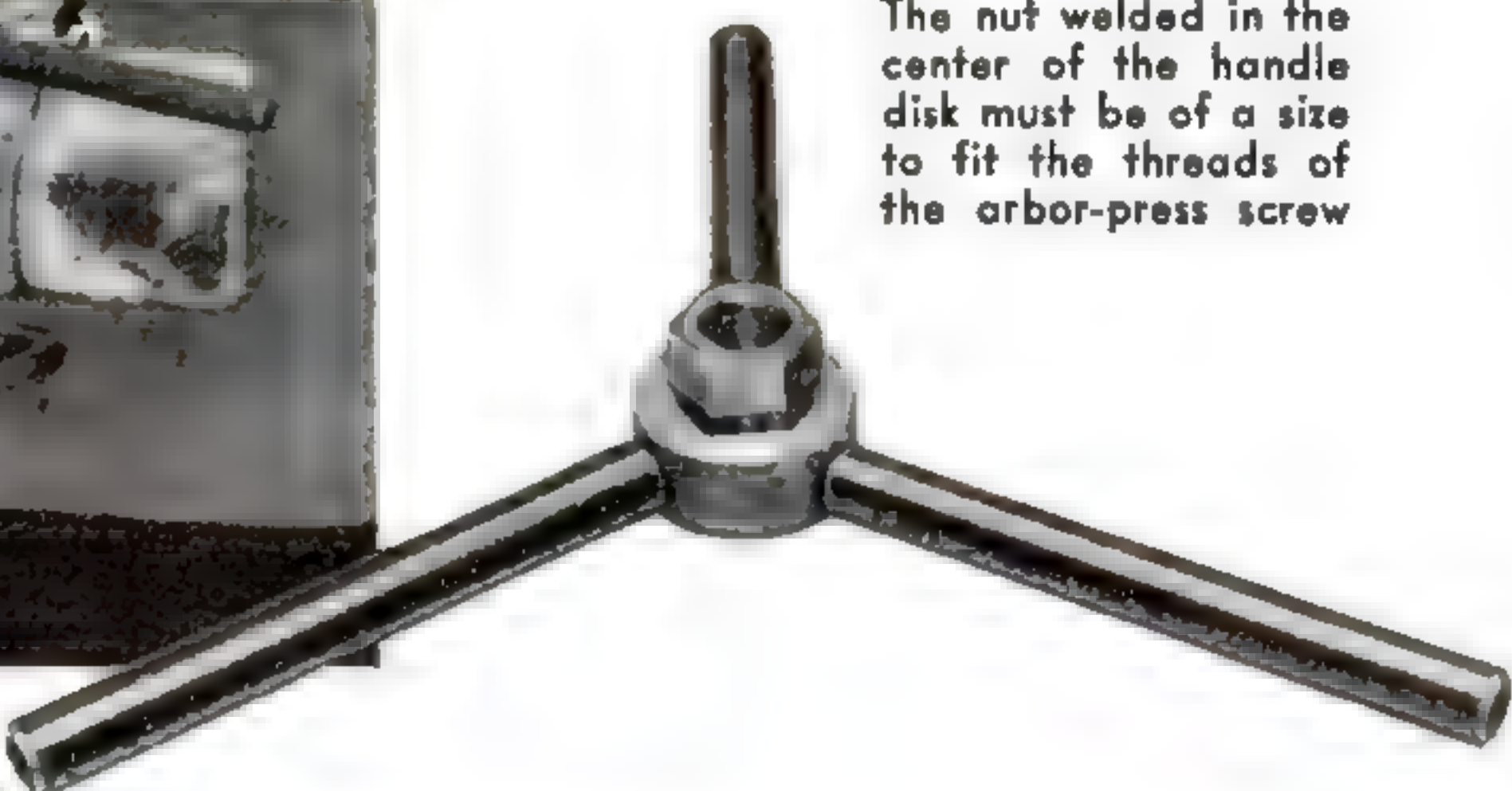
To weld the threaded sleeve to the body, place it in position, heat both pieces to a dark red, and spot the sleeve to the body at each end. Starting at one end, weld that seam completely; then weld the other seam in a similar manner.

The bed of the press is made of the same material as the body, the two parts being bent as shown. The bed is held to the body with two finished machine bolts, and the bolt holes must be true and smooth. Note that there are three sets of holes for adjusting the height of the bed.

In using the press, set the work on the bed so that the pressure will be equally divided on the arms. If a piece of shafting has to be straightened, place a piece of heavy sheet copper or aluminum on the arms of the bed and also under the plug. Keep the screw well lubricated with graphite grease or white lead in heavy oil.



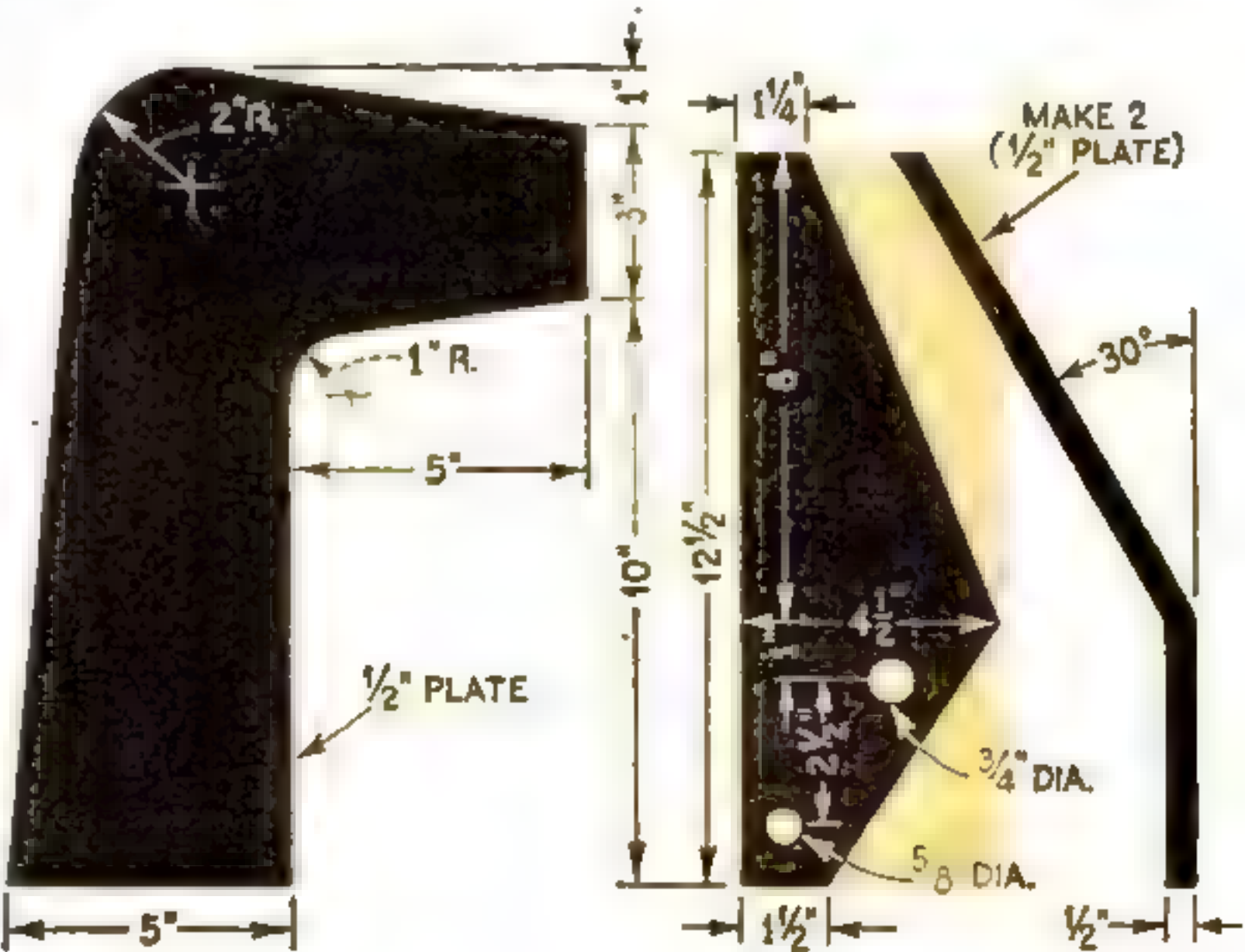
The handle is formed by welding a nut to the center of a heavy disk, then welding on three pieces of pipe



The nut welded in the center of the handle disk must be of a size to fit the threads of the arbor-press screw



Welding the upright to the base requires care. A little is done on one side, then on the other. At right, the body and bed

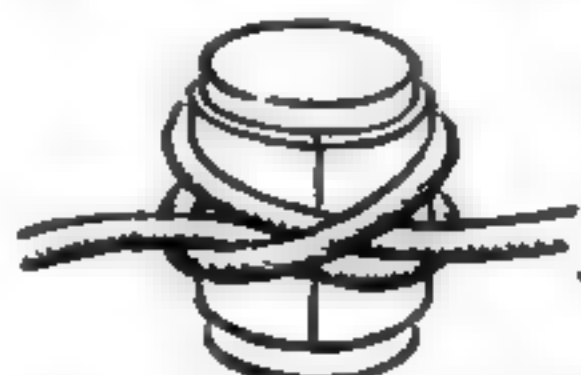
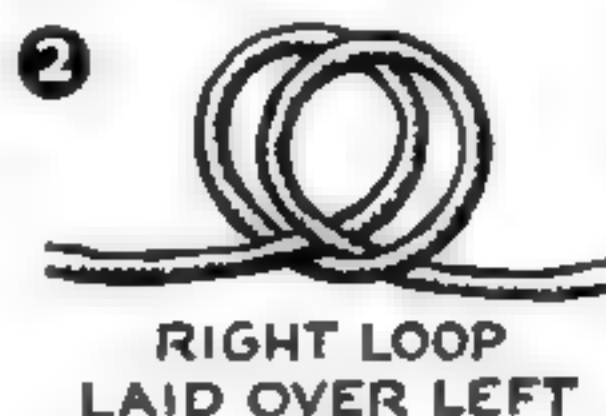
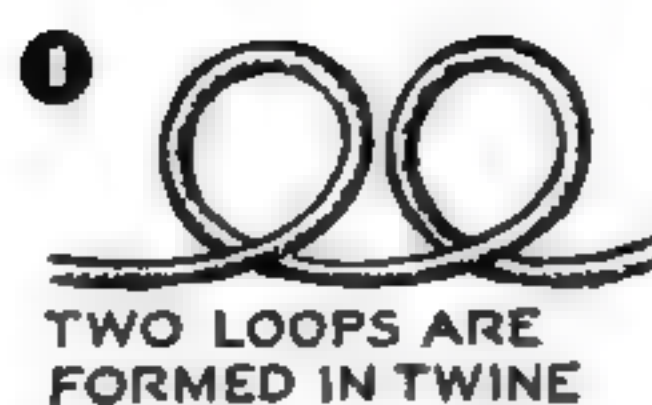


Clove Hitches Serve Many Shop Purposes

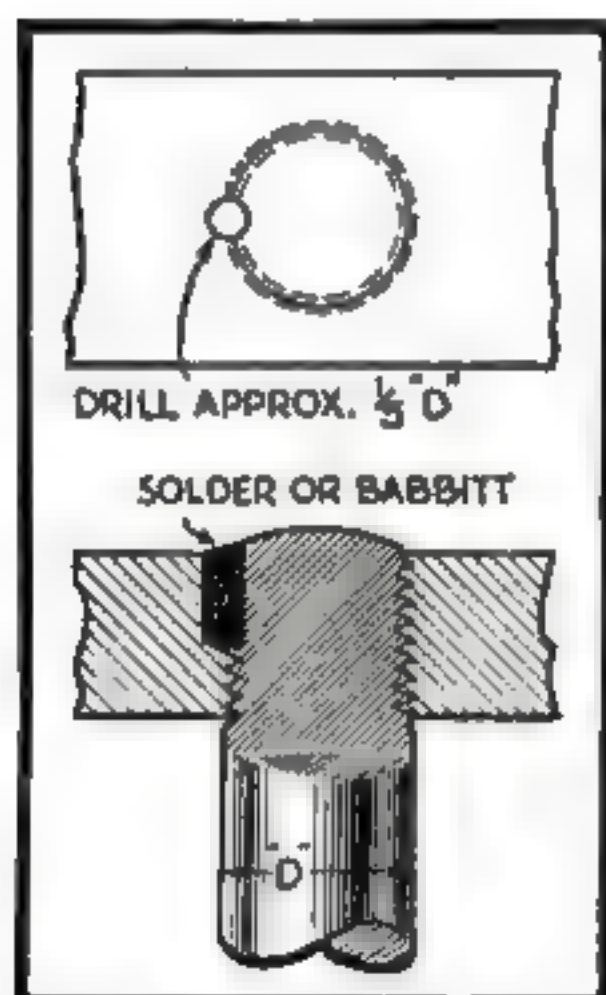
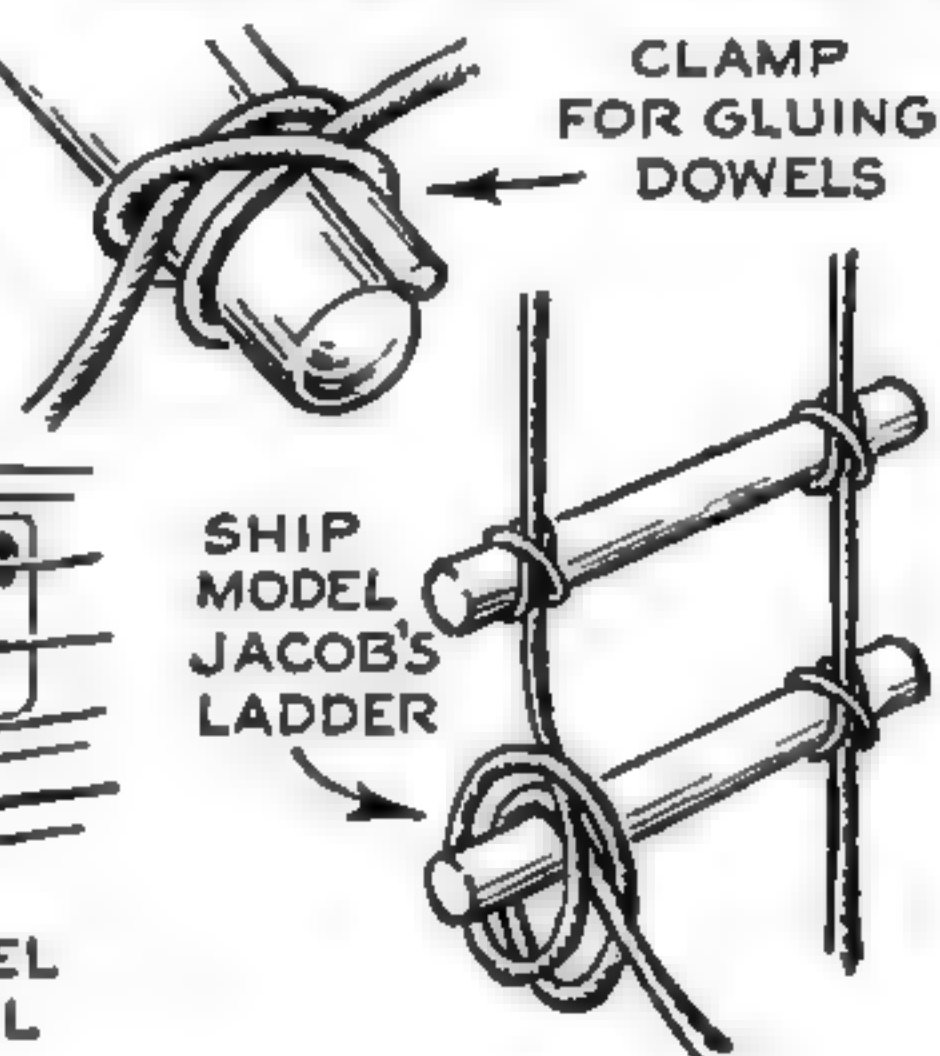
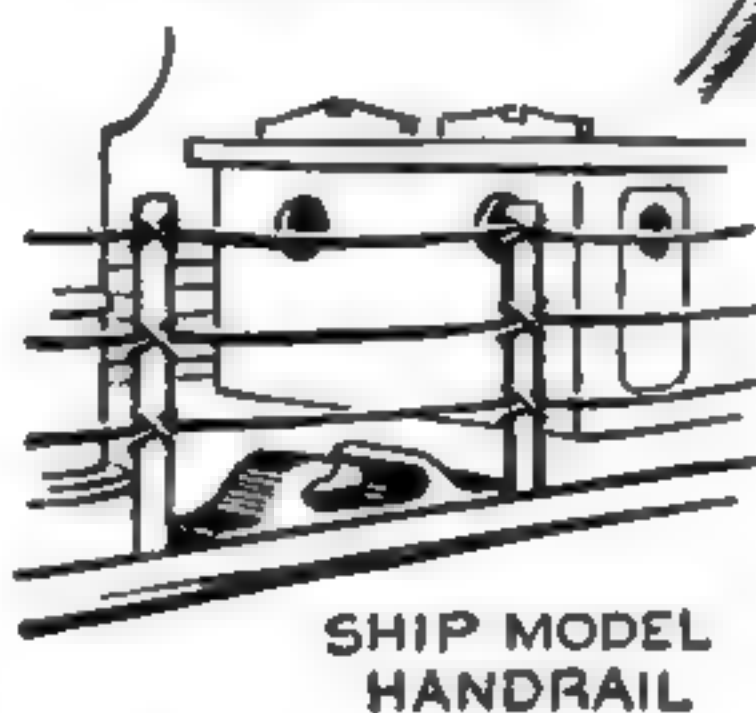
ALTHOUGH the clove hitch is such a familiar knot, few craftsmen realize how useful it is for many shop purposes. It serves instead of clamps for gluing two or more dowels together and other gluing operations, and it is also excellent for the quick assembly of ship-model handrails, rope ladders, and wire fences for model-railway layouts. When the gaff jaws and other small parts have to be glued to the booms and yards of a ship model, the clove hitch is better than metal clamps because it doesn't slip and will not crush small fittings. The hitch is instantly fastened or loosened.—E. F. H.

Old Piston Ring Keeps Small Parts Together

WHEN taking small mechanisms apart, I lay the screws and pieces inside an old piston ring. This prevents them from being brushed off the bench and lost, but they are easily picked up because the ring is not as deep as the usual can lid.

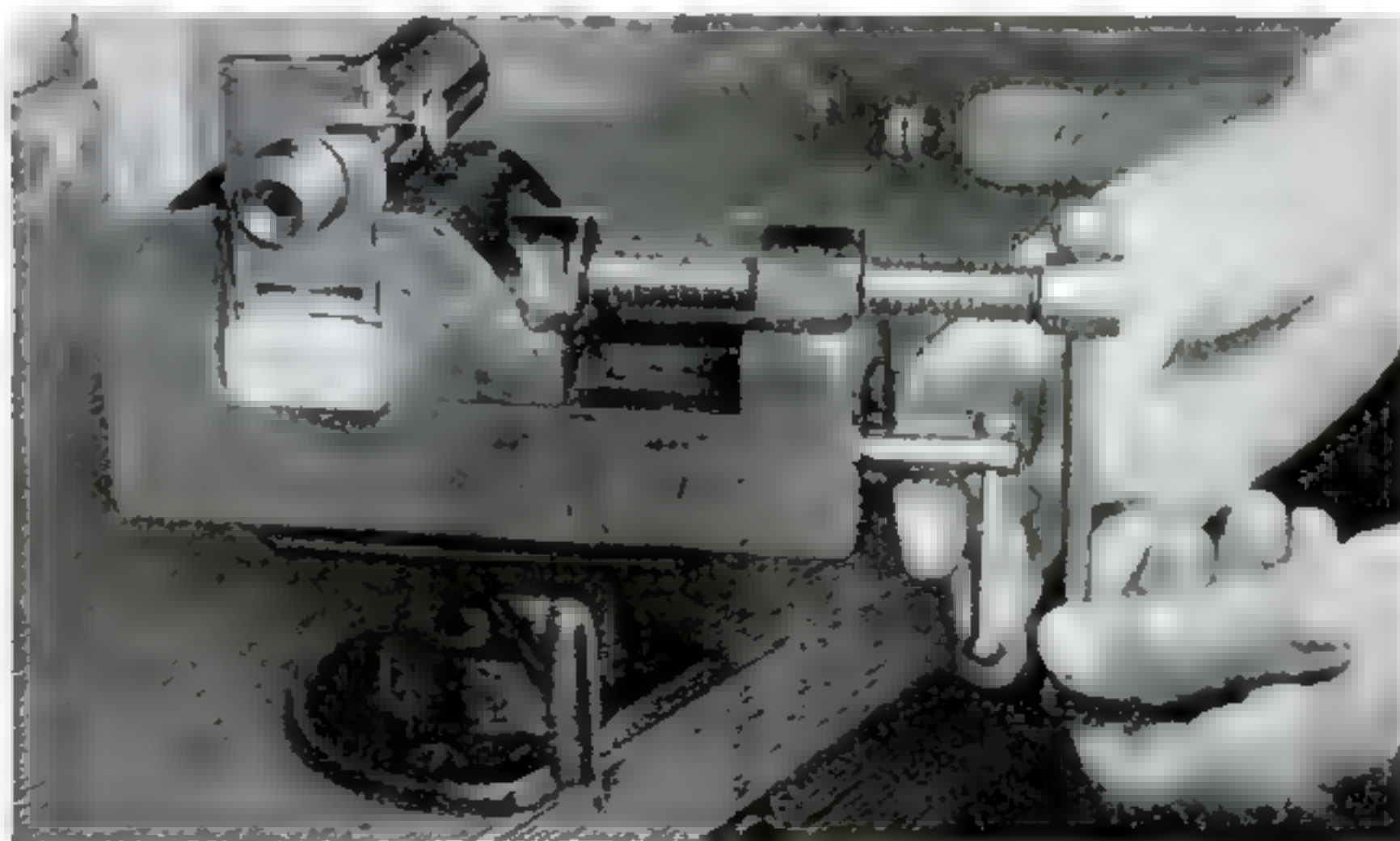


CLAMP FOR GLUING COLLARS TO MASTS AND DOWELS



Fastening a Vise to Its Base

BENCH vises that are removable from their bases for use on drill-press tables are usually held in place by a set screw, but this is difficult to tighten sufficiently to hold the vise firmly for heavy work. The illustration shows a much more convenient way to remove and attach the vise. The set screw is replaced by a small replica of the main vise screw, the inner end being threaded and pointed like the original set screw. The small slip handle, when placed centrally, turns without striking the main screw.—C. W. HOUGH.



A Lock for Screws

MATING threaded parts may be locked to prevent them from loosening or changing relative position by the method illustrated above. Drill a hole at the junction of the two members, then flow in solder or molten Babbitt metal and file off any surplus. This procedure does not mutilate the parts, and the soft metal is easily drilled out if it should be necessary.—R. C. R.



The 12' by 13' shop has plywood walls enameled white to reflect the light. The floor is green



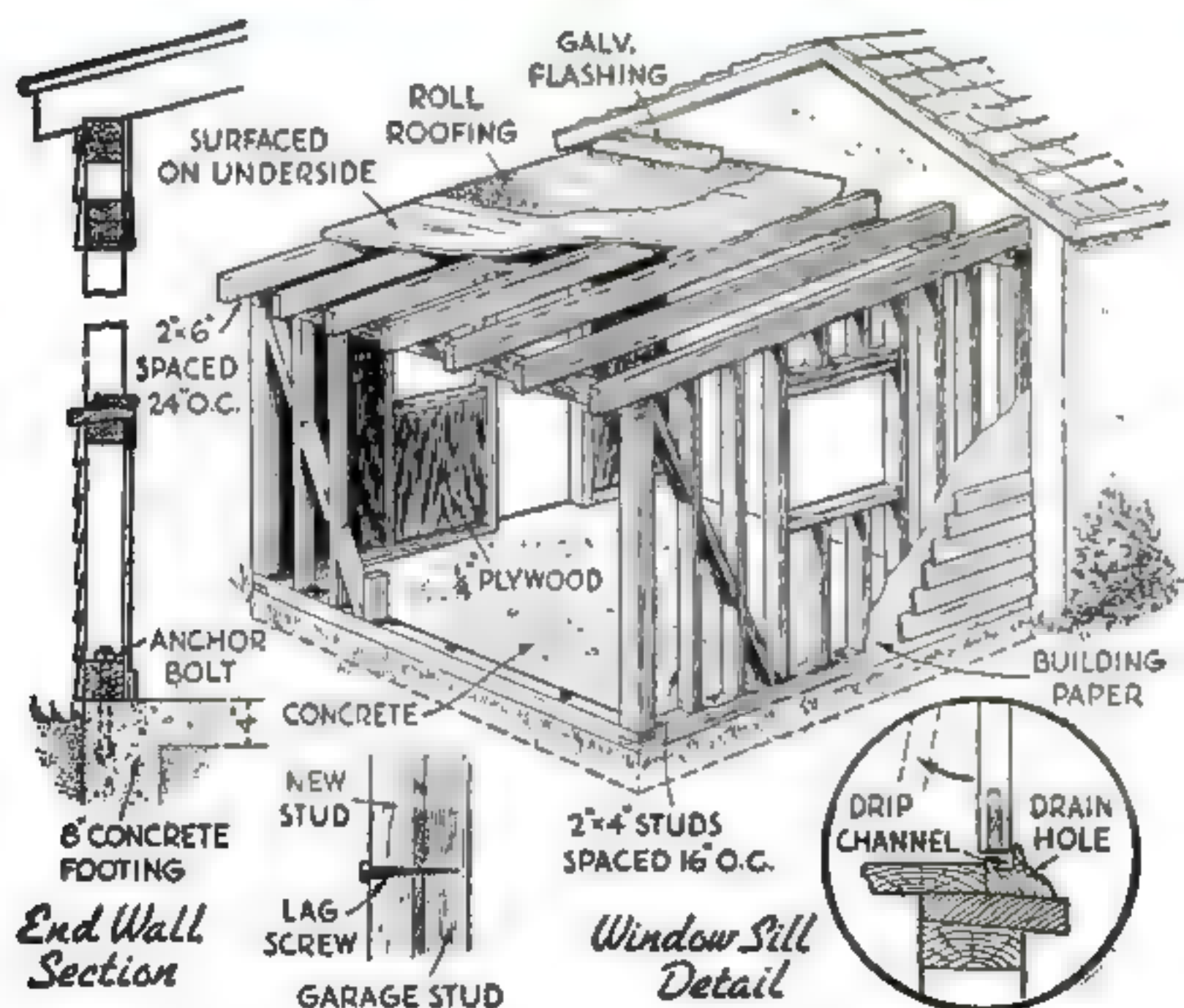
At top, the owner designing a new model airplane part in a corner of the shop. Above, how the exterior looks

Light, Airy Workshop Housed in a Small Addition to a Garage

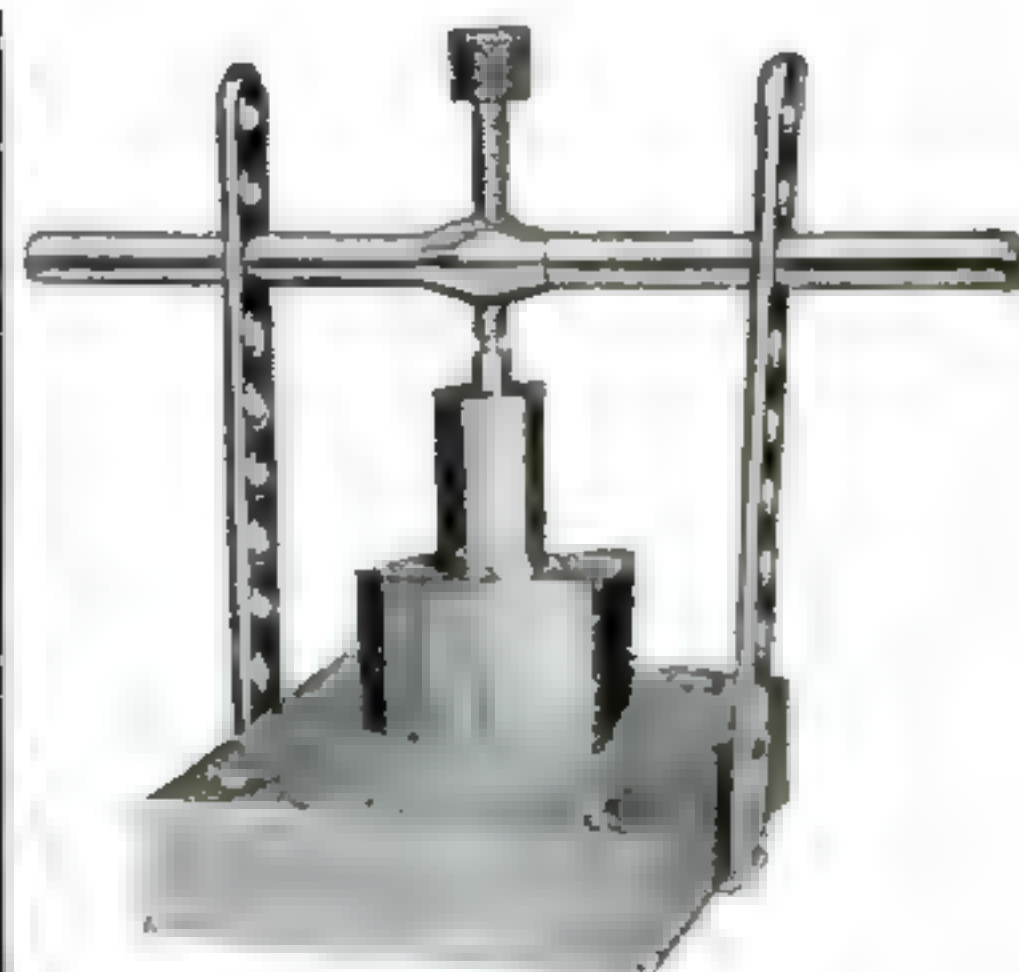
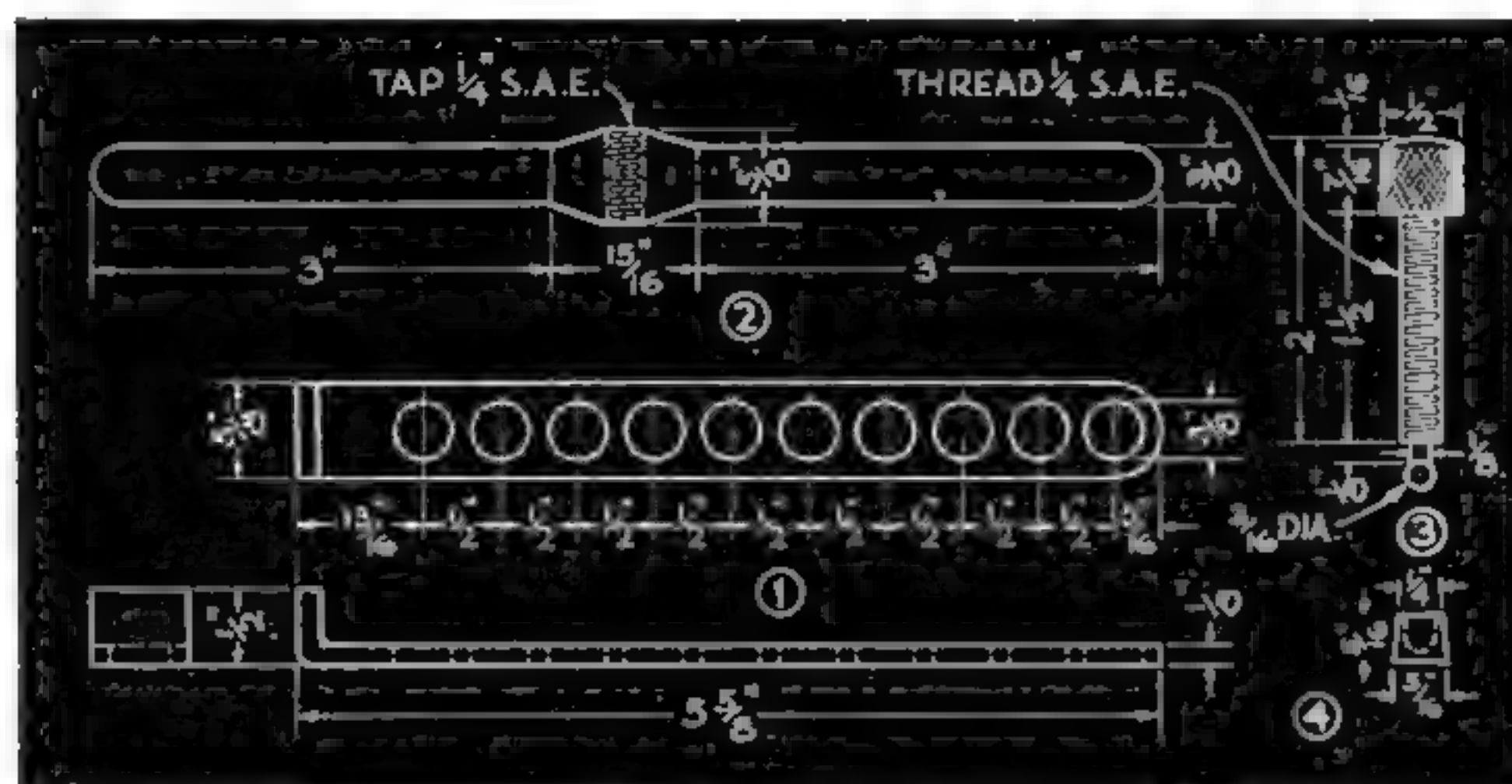
THIS exceptionally light and airy workshop added onto the end of a garage is the result of careful workmanship rather than expensive materials. It was built by Lester Hall, of Pasadena, Calif. With some modifications, a similar workshop can be constructed against almost any existing structure. In those sections of the country where there are heavy snows, a steeper pitch should be given the roof, if it is not practicable to sweep or scrape off accumulation; and the building should be better insulated.

In any locality, a concrete floor will be found an advantage. To avoid the cold in winter, lay a panel of insulating wall board to stand on. This can be moved about to whatever part of the shop work is in progress. If heating cannot readily be obtained from the central plant in the house, a so-called "air-tight" stove, which consumes shaving and litter, will give an amazing amount of heat.

The general construction is as indicated in the drawings. For thorough ventilation, the windows are hinged at the top and swing in. The inside walls are paneled with $\frac{1}{4}$ " plywood, with battens over the seams. A fine gloss finish has been attained at moderate cost by applying, first, boiled linseed oil, then two coats of flat white, and finally one of enamel.



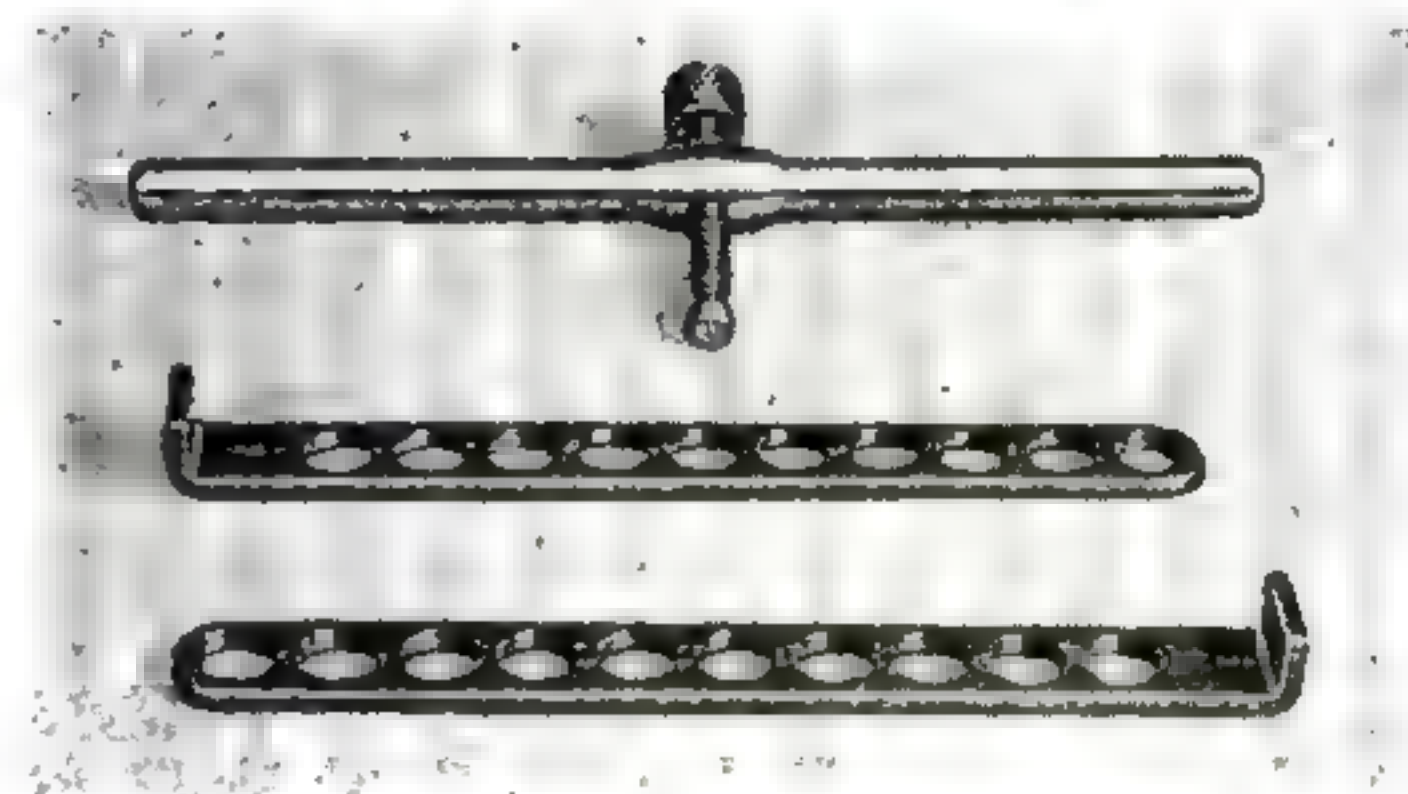
An Adjustable Clamp for Tool and Die Makers



Working drawings and, at right, a view to show the separate parts and another to illustrate the advantages of the tool for scribing contours

INVALUABLE to a tool or die maker, this clamp makes it possible to scribe entirely around the contour of a punch or template. The parts marked No. 1 are two pieces of $\frac{1}{8}$ " by $\frac{5}{8}$ " by $6\frac{1}{8}$ " cold-rolled steel. These are clamped together, drilled with a $\frac{23}{64}$ " drill, and reamed to $\frac{3}{8}$ ". One end of each is then bent as shown.

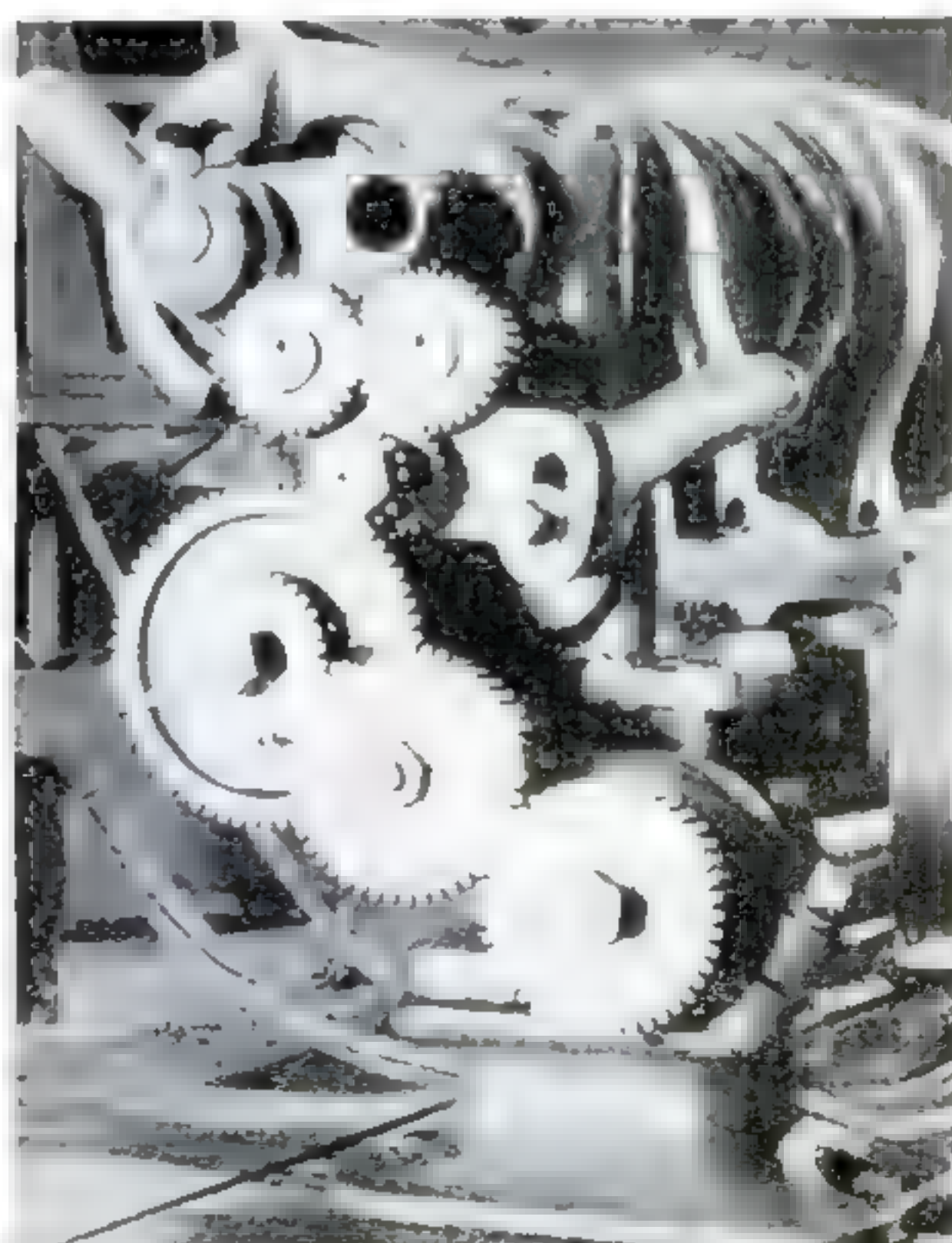
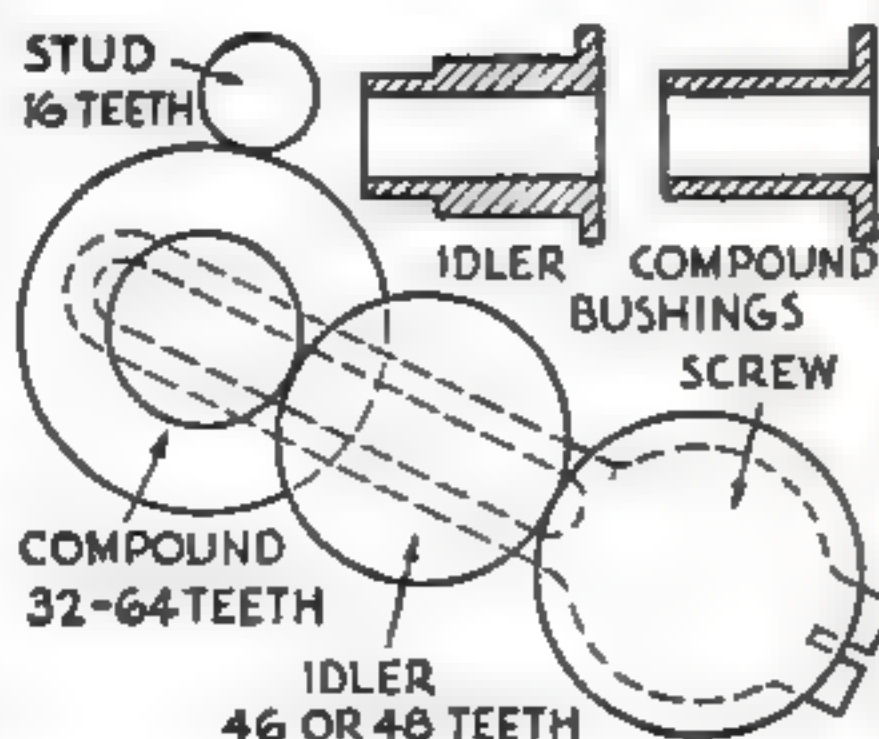
For part No. 2, turn a piece of $\frac{5}{8}$ " drill rod $6\frac{15}{16}$ " long so the ends will slide freely in the reamed holes of parts No. 1, and drill and tap the center as indicated. Harden and draw to a blue. The screw, No. 3, is made from $\frac{1}{2}$ " drill rod to fit the tapped hole of part No. 2. On the end a $\frac{3}{16}$ " ball is turned. The screw is then hardened and drawn. Part



No. 4 is turned from drill rod. The hole may be drilled with a $\frac{3}{16}$ " drill, the point of which has been ground to a $\frac{3}{32}$ " radius. Drill the hole a little deeper than the diameter of the ball. Insert the ball in the hole and curl over the edges of part No. 4 in order to retain it.—WALTER F. DEBOLD.

Compounding Lathe Gears to Cut Fine Threads

AMATEUR machinists who own one of the popular types of bench lathes equipped with only simple gearing may compound its change gears to cut almost all the usual fine threads. The compound gear is prepared by pinning together the 32- and 64-teeth gears. A bushing must be made to carry this assembly, as well as a bushing for the new idler gear to hold it in line with the screw gear and the small compound gear. The screw gear is held at the proper position by the spacing collar. The idler gear is one having 46 or more teeth. Another bolt, similar to the one already in use, is also needed to hold the extra gear on the bracket.



Making Cove Cuts on a Circular Saw

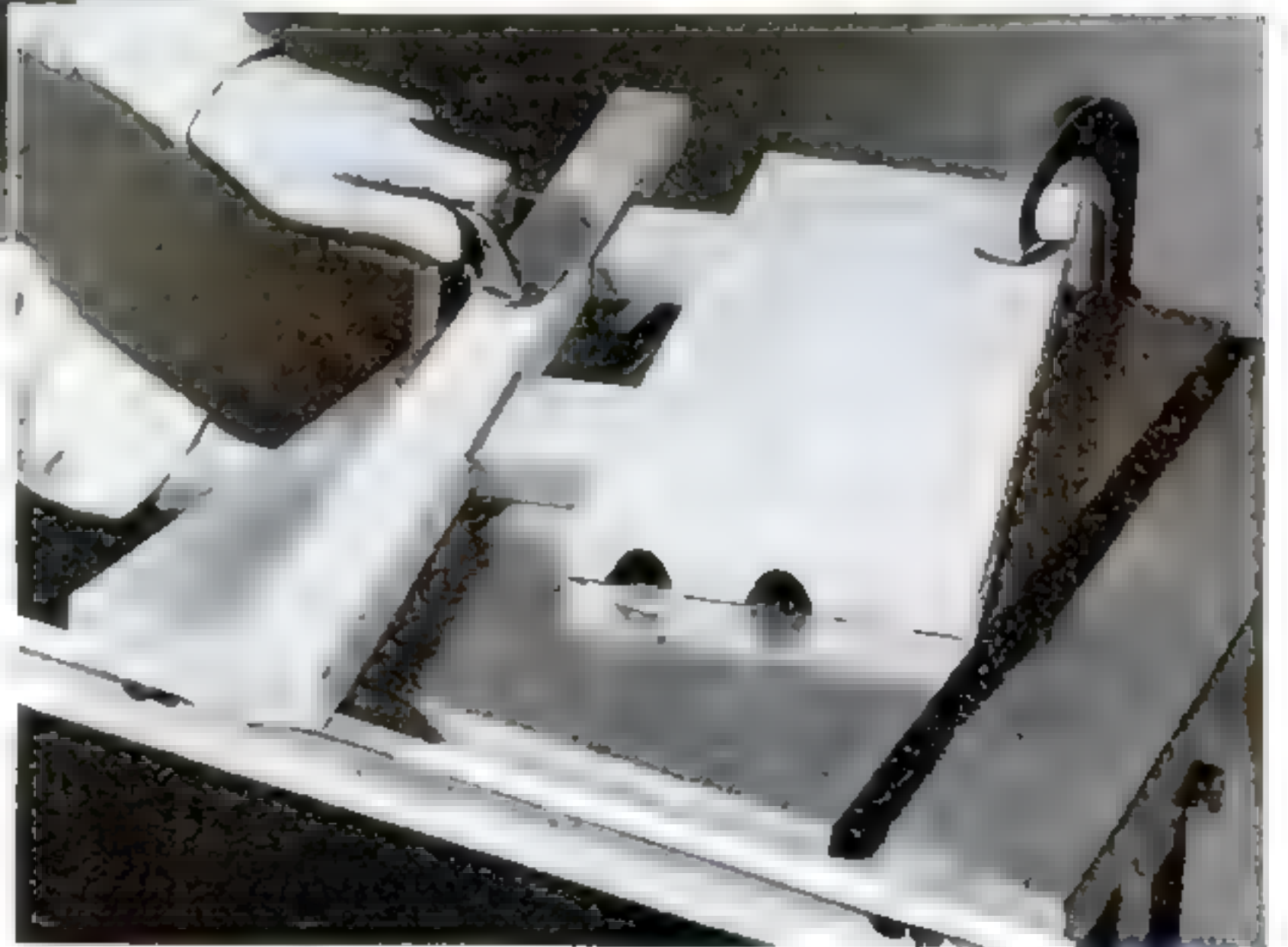
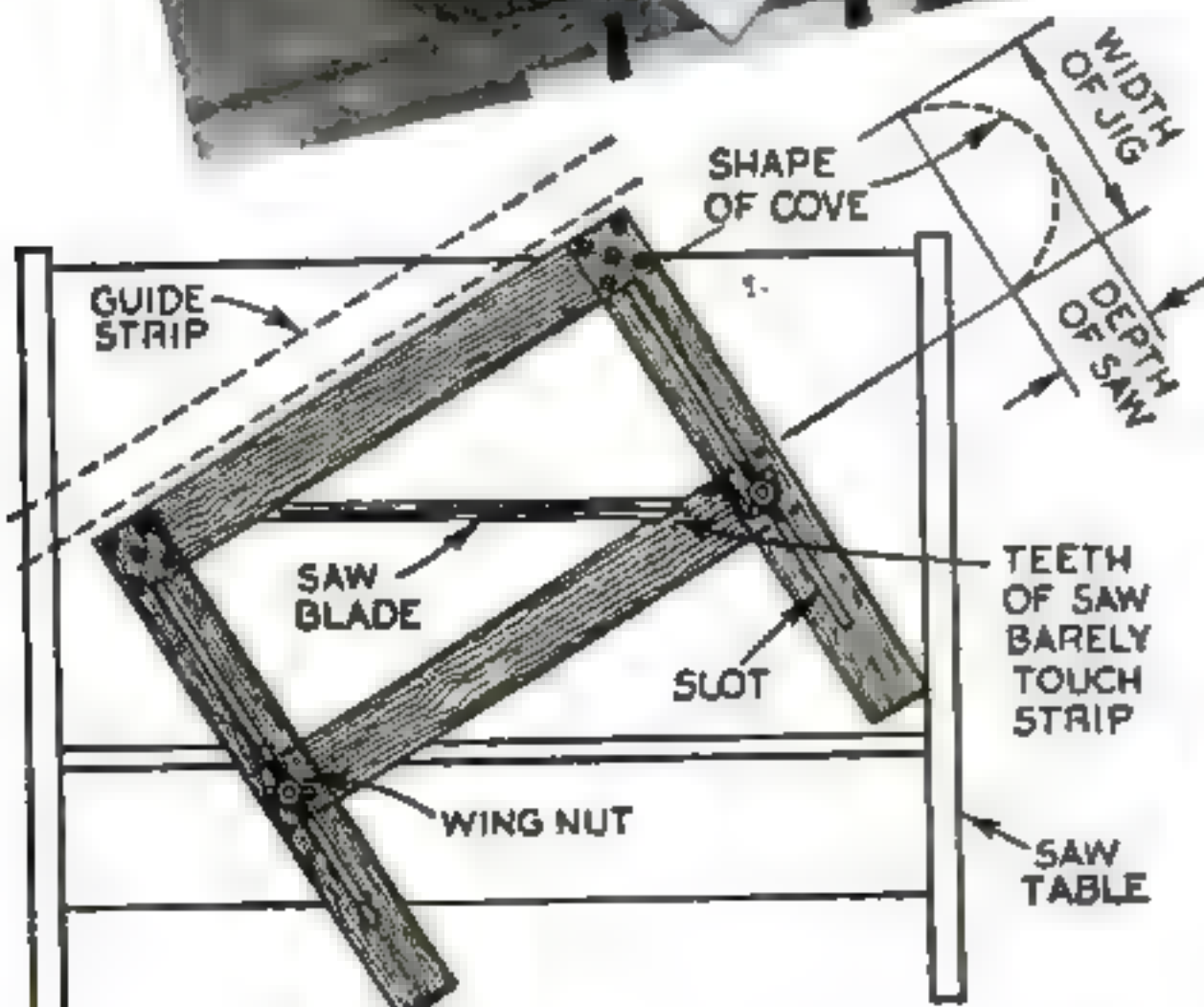


CRAFTSMEN who use the circular saw to make cove cuts will find that a jig of the type illustrated at the left will enable them to cut coves at the ends of a board and at all angles. It also permits all regular miter-gauge attachments to be used.

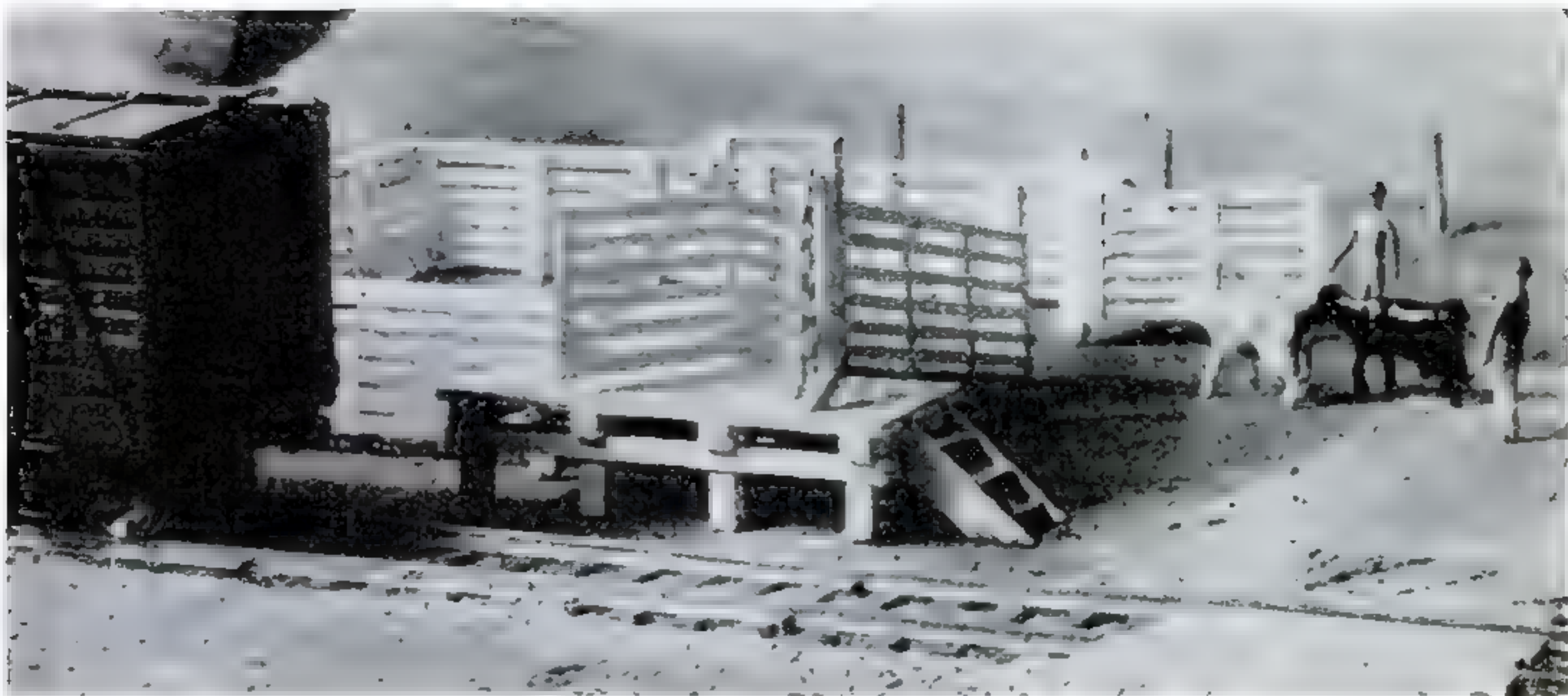
For ordinary work, where a guide strip is to be used, it is easy to determine the angle at which the strip should be clamped by making a jig as shown in the second photograph. Adjust the saw blade to a height equal to the depth of the cove, and adjust the strips of the jig so that the distance between them is equal to the width of the cove. Place the jig over the saw blade and turn it until the tips of the teeth barely touch the strips of the jig. The guide strip is then clamped on the table at the same angle.

When parallel coves must be cut, make the first cut in the usual manner, then return the board to a central position and clamp it. Loosen the guide strip and move it over enough to allow two pieces of wood to be inserted as shown below. These should be as wide as the center-to-center distance between the desired cove cuts. The guide strip is re-clamped, the work loosened, the blocks removed, and the next cut made.—H.R.H.

Upper left, a universal jig for cove cuts made from a wide 1" board, grooved on top for the miter-gauge bar and with a notch in one edge. Left, the jig for finding angles



Parallel coves are spaced accurately by using two blocks of wood as wide as the center-to-center distance between coves

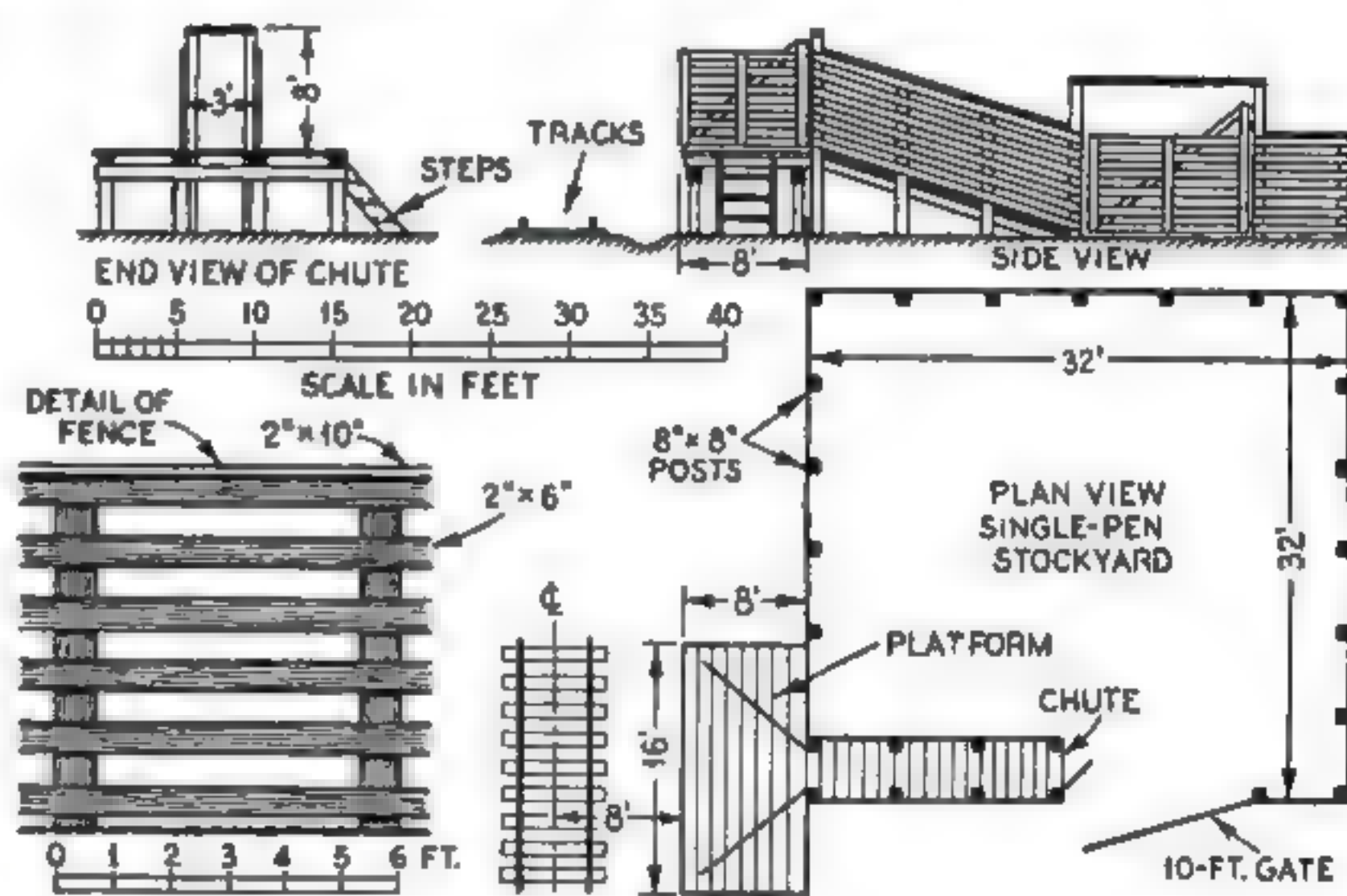


Stockyard for Your Model Railway

IF YOU have a flag-stop siding along the main line of your model railway, the addition of this one-pen stockyard or corral will attract attention. Lay out each of the four sides to scale on heavy white cardboard. Cut the horizontal fence boards from thin strips of wood and fasten them lightly to the cardboard with thin flour-and-water paste, right over the diagram. Cut the fence posts from pine or balsa and glue them to the fence boards. After the glue has set, the sides can be removed, each side a complete unit. The gates and the sides of the loading chute are built up in the same way.

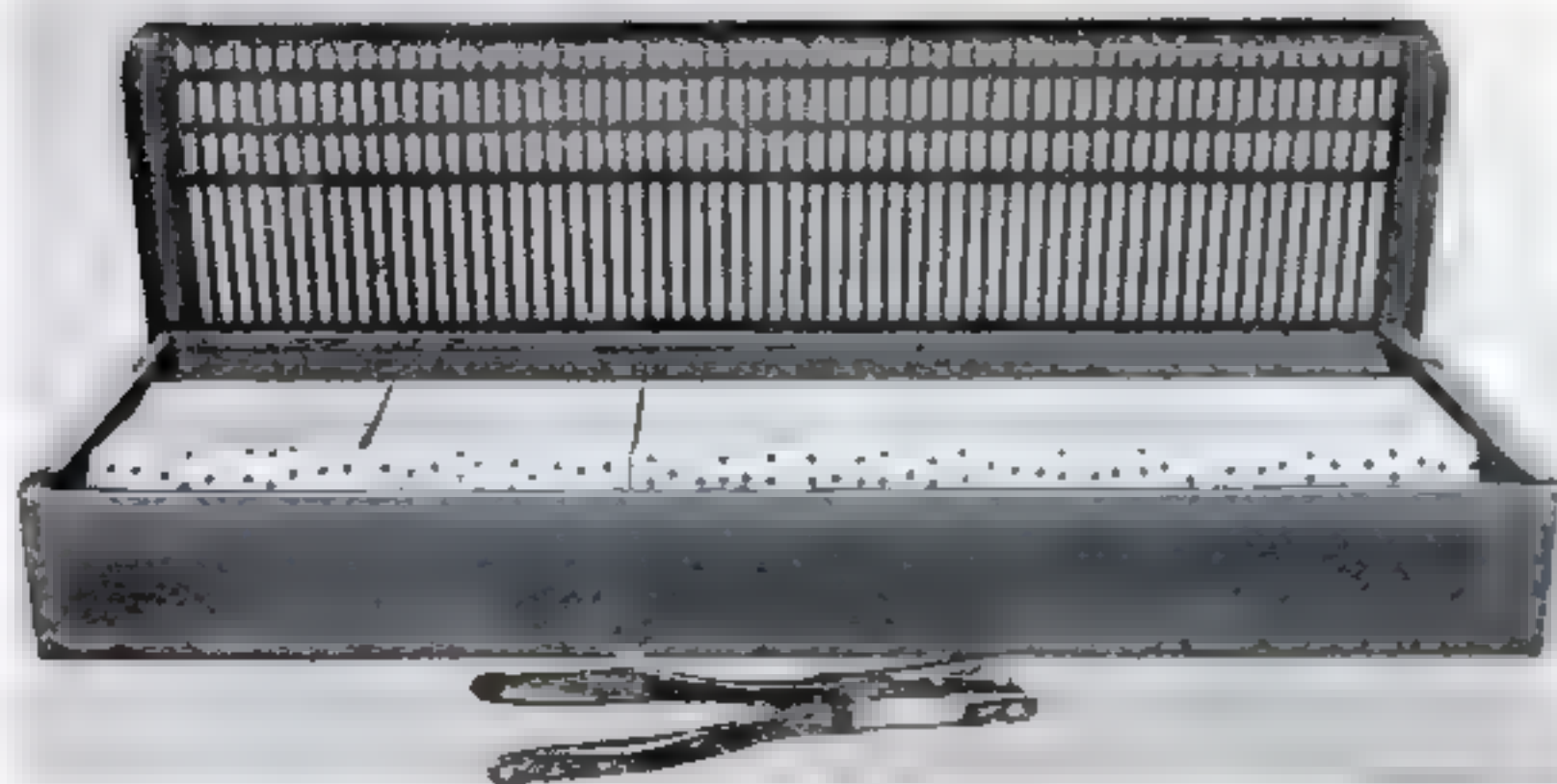
You can save a lot of time and work by obtaining a Japanese calendar and using the strips of wood from it. These strips, which are ap-

proximately $\frac{3}{16}$ " wide, will, when split, provide planking and fence boards for the entire stockyard.—J. W. CLEMENT.



One-pen stockyard. At top of page, model scaled to HO gauge

Blotters Serve as Wick for Radiator Humidifier



Twin-pan radiator humidifier with new wick of blotting paper

WHEN the cloth wick of a twin-pan radiator humidifier becomes useless, an efficient substitute may be made from blotting paper. Cut clean blotters to such dimensions that they will reach slightly more than across the top of the humidifier from front to back and just cover the top lengthwise when placed side by side. Fold them in halves the long way and punch them full of holes; then open them out, place them across the wire supports, and bend them down in, so that the ends touch the pan bottoms.—A. MORRIS CROSBY.

Home

**This Common Substance
Supplies Carbon Dioxide
and Arctic Temperatures
for Various Experiments**

**By
RAYMOND B.
WAILES**



Carbon dioxide, formed by allowing dry ice to vaporize, is reduced to carbon monoxide by passing it over red-hot charcoal

TWO properties of dry ice, or frozen carbon dioxide, make it a fascinating material for amateur chemical experiments. Since it vaporizes spontaneously at normal room temperatures, it provides an ideal source of carbon dioxide gas. In addition, its temperature of minus seventy-seven degrees centigrade, or 107 degrees below zero Fahrenheit, offers extreme cold for experiments that can be performed in no other way.

Widely used today as a refrigerant for ice cream and other perishables, dry ice often is available as a "by-product" after a party or picnic. You need not wait for such an occasion, however, since you can buy this solidified form of carbon dioxide at many stores that sell ice cream. Avoid letting it touch your bare skin, to guard against the possibility of severe frostbite. You can handle it safely by using a hammer to break up the solid lumps, and a spoon to transfer the pieces to containers in which they are to be used.

Drop several pieces of dry ice into a wide-mouthed bottle. In a few minutes, the evaporating fragments will fill the bottle with carbon dioxide gas. Now insert a burning strip of magnesium ribbon. Instead of being extinguished, as a lighted match would be,

the magnesium continues to burn brilliantly, and black flakes of carbon appear. The magnesium tears the carbon dioxide apart in this showy experiment, combining with its oxygen to form magnesium oxide, and leaving free carbon behind.

Red-hot charcoal also robs carbon dioxide of its oxygen, but does not take it all. In this case, carbon monoxide, containing half as much oxygen as carbon dioxide does, is left. A flask containing a few lumps of dry ice, and fitted with a one-hole stopper, will serve as a



With dry ice, you can find out exactly how much protection the antifreeze mixture in your car gives you

Tests with Dry Ice



A frozen solution of salt in water is a nonconductor of electricity, as this simple test proves

generator of carbon dioxide gas for this experiment. Lead the gas through a horizontal iron tube about sixteen inches long and half an inch in diameter, filled with pea-size particles of charcoal or coke. Meanwhile heat the center of the tube, at least to dull-red heat, with one or more Bunsen or Meker burners. Apply a lighted match to the gas issuing from the end of the tube. It will burn, since the incombustible carbon dioxide has been transformed into combustible carbon monoxide. This is the toxic gas that is found in automobile exhaust fumes, and that also forms an important ingredient of manufactured gas. In your experiment, as in your household gas range, the poisonous quality of the carbon monoxide is immediately destroyed by burning it.

The powerful chilling effect of dry ice can be turned to practical advantage in your home laboratory, for testing the freezing point of radiator antifreeze solution quickly and accurately. One garageman may tell you that the mixture in your car's radiator is "good for ten below zero." An attendant in a service station a block away may say only two below zero, and urge you to buy another quart. But if you make this simple test, you will positively know for yourself. Place in a test tube about ten cubic centimeters (or three teaspoonfuls) of the water-and-antifreeze mixture you are using, and insert the test tube in a can or beaker filled with dry ice. Stir the solution with an all-glass, or laboratory-type, thermometer that reads well below

• SAFETY FIRST •

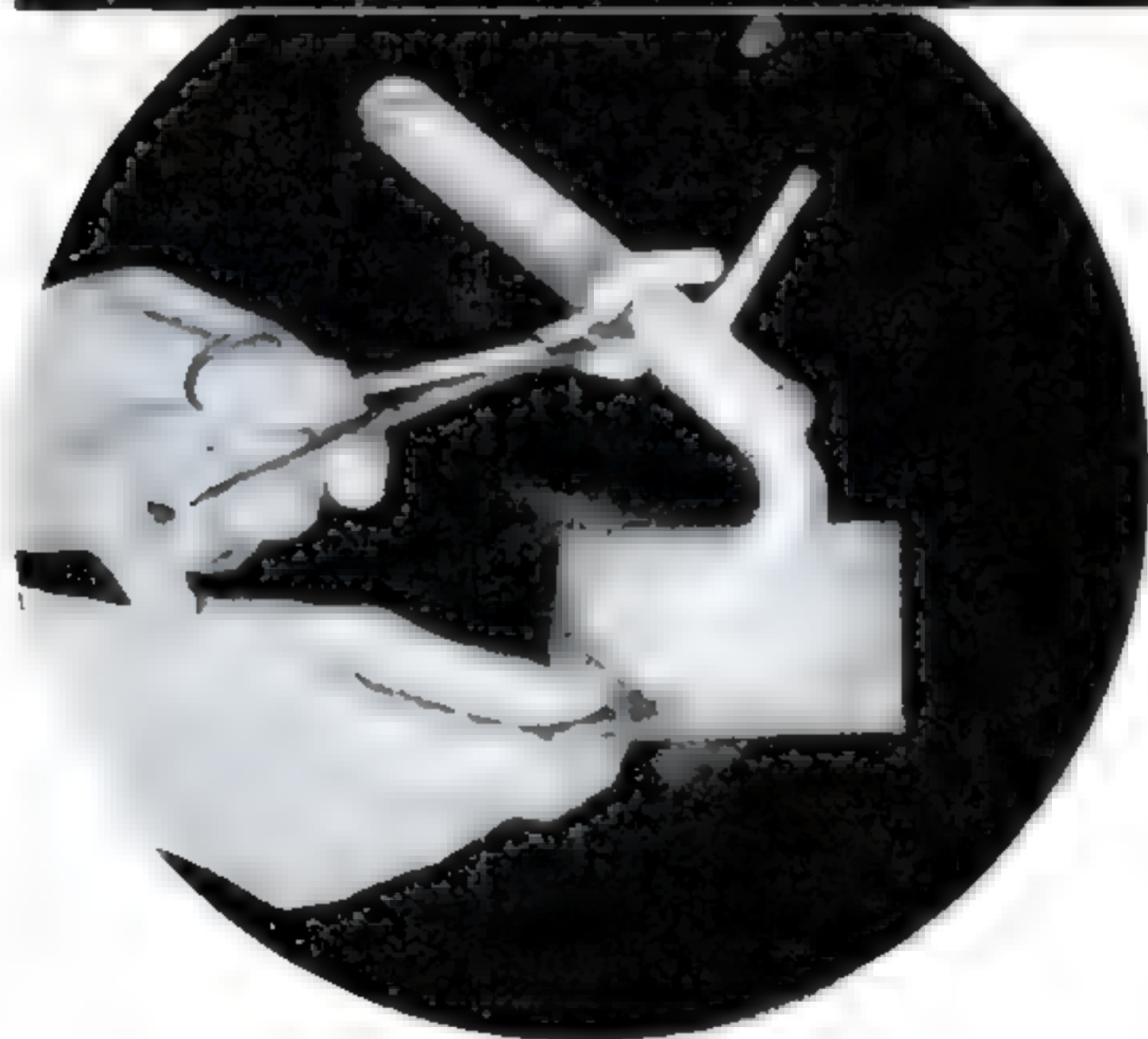
FROM time to time in the articles of this series, you will notice warnings and cautions, as in the directions for handling dry ice and liquid ammonia. *Make sure to follow them to the letter.* They were put there for good reasons—so that you can enjoy fascinating experiments that are perfectly safe when carefully performed, but may be dangerous otherwise.

It would be ridiculous to ban tincture of iodine from the house because it is poisonous, but you do use this and other common household poisons with the care that is due them. Likewise, a good chemist regards every chemical on his shelf as poisonous unless he has positive knowledge to the contrary. An unfamiliar chemical in his test tube may have a violently acrid or irritating vapor; to note its odor, he does not put his nose to the mouth of the tube for a whiff, but holds the tube a foot or two away and gently wafts the air above it toward him with his hand. He avoids mixing chemicals indiscriminantly, "to see what will happen." He keeps highly inflammable and volatile liquids away from a Bunsen burner; and handles strong, corrosive acids like nitric and sulphuric acids with the utmost respect, since they can burn skin and clothing if carelessly splashed about. Using dry ice introduces the novel warning to keep from touching this extremely cold substance, just as you would avoid putting your hand in boiling water. By observing reasonable precautions like these, you can safely enjoy your mastery over powerful chemical forces.

the freezing point of water. When the liquid in the test tube becomes slushy, read the thermometer. This reading is the freezing point of the mixture, and therefore the lowest temperature at which it will protect your car.

Electric current travels readily through a solution of a salt in water. If you freeze the solution, will it continue to conduct electricity, or will it become a nonconductor? Here is a chemical brain teaser that you can answer by trying the experiment yourself, with the aid of dry ice as a chilling agent.

Dissolve about a gram, or a scant quarter teaspoonful, of ammonium chloride in ten cubic centimeters of water, and place the



MAKING LIQUID AMMONIA. This is the set-up for turning ammonia gas into a liquid of the kind used in refrigerating systems. At the left, the frigid liquid is being poured out onto a glass plate

solution in a small U tube. For a source of electricity, wire up two or three dry cells. Provide some device to indicate a flow of current, such as a flash-light bulb or a galvanometer of the familiar "tangent" or coil-and-compass type. Complete the circuit through wires bared of insulation at the ends, which dip into the liquid in each limb of the U tube. The dry cells, current indicator, and U tube should all be connected in series, or so that current passes through each one in turn,

as shown in the illustration. When this has been properly done, electricity will flow through the solution and the compass needle will swing, or the flash-light bulb will light up.

Now repeat the test, after freezing the solution by placing the U tube in a bath of dry ice. The absence of any response from the compass needle or flash-light bulb shows that no current is flowing. The frozen solution is a nonconductor of electricity. In liquid water, a dissolved salt forms "ions" or particles that carry electric current; these ions are not produced in solid water, or ice. A small U tube is preferred for the test because one of half-inch or larger diameter may be cracked by the expansion of the solution as it freezes.

Would you like to perform the fascinating experiment of turning ammonia gas to a liquid—not a fluid like household ammonia, which is simply a solution of the gas in water, but the pure liquid ammonia that is used in refrigerating systems? To do it, you will have to chill gaseous ammonia to within a few degrees of the forty-below-zero tempera-

ture at which centigrade and Fahrenheit thermometers read the same. Using dry ice, you can easily assemble apparatus that will create this miniature Antarctica in a test tube. Enough liquid ammonia will be produced to enable you to test a number of its interesting and unfamiliar properties.

The ammonia gas that serves as the raw material can be produced simply by heating about 100 cubic centimeters, or three fluid ounces, of ammonium hydroxide solution in a flask with a one-hole outlet. Or you can use a mixture, in water, of practically any ammonium salt with any caustic. For example, place some caustic soda (lye) in a beaker and add enough water to dissolve it. When the solution has cooled, pour it into a flask containing powdered ammonium chloride—an inexpensive chemical commonly sold as sal ammoniac. Roughly equal quantities of the two chemicals, either by weight or volume, may be used. If you heat this mixture or the ammonium hydroxide in a round-bottomed flask, the spherical surface will minimize “bumping” or objectionable jiggling when it boils.

With rubber or glass tubing, lead the ammonia gas to the top of a vertically mounted condenser. This may be the serviceable homemade condenser described on this page. Its lower end should be inserted in a flask, either

of the ordinary or side-necked variety. The condenser and empty flask form a preliminary cooling system to condense and remove any water vapor mixed with the ammonia. Preferably the condenser should be cooled with running water; but if your home laboratory does not have a supply, use the condenser anyway. Without the connections to its water jacket, it will still serve as an “air condenser” and remove enough water vapor, provided you do not heat the ammonia-generating flask too strongly nor prolong the experiment beyond, say, fifteen minutes.

From the empty flask, lead the ammonia gas in turn through a pair of side-necked test tubes embedded in dry ice. The first tube, which is left empty, serves to condense and collect the liquid ammonia. As an additional experiment, place a few crystals or half a gram of zinc chloride in the second test tube.

Start the evolution of gas by heating the ammonia-generating flask. When your “run” has been progressing for about five minutes, counted from the time when the solution has become good and hot, disconnect the first side-necked test tube from the apparatus and reattach the second one. Remove the first tube from its dry-ice bath. It will contain anhydrous, or water-free, liquid ammonia.

Cautiously pour (*Continued on page 250*)

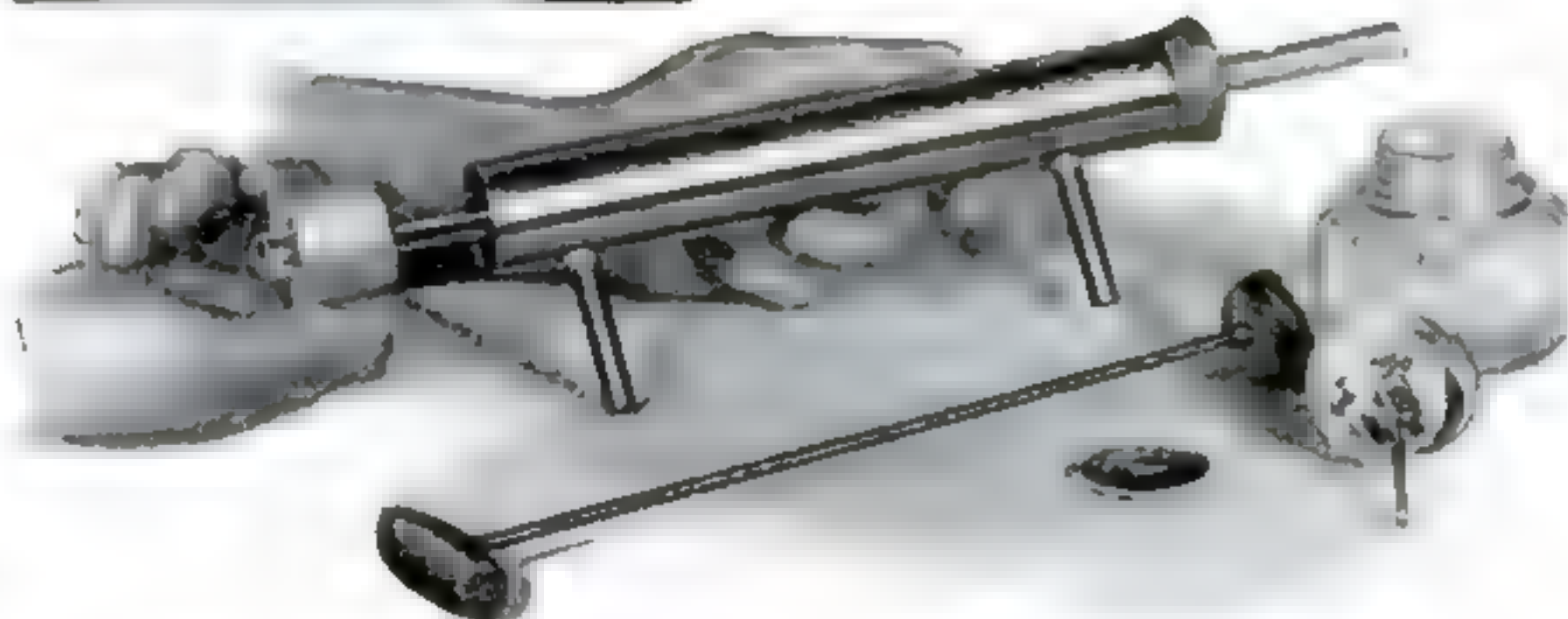
NEED A CONDENSER? YOU CAN EASILY MAKE THIS ONE FOR YOURSELF



THIS simple homemade condenser will prove a boon to you for many interesting experiments, including making liquid ammonia by the method described above. Its tinned-iron jacket is the cylinder of a ten-cent fly-spray gun. Small metal tubes, soldered to holes near the ends, provide an inlet and outlet for a cooling stream of water. Vapors to be condensed pass through an inner length of glass tubing, not less than three eighths of an inch in diameter.

By making dents in the glass tubing, you can increase its condensing surface, and improve the efficiency of your condenser. To do this, bring a spot on the tubing wall slowly into a Bunsen flame, and heat it until the softened glass is

workable. Then push this spot inward with the tang of a file. Repeat the procedure all along the tube. Do not let the end of the file become red-hot, or it will stick to the glass and pull a hole in the tubing. Mount the glass tubing within the jacket, with corks or rubber stoppers at the ends. If you use corks, and they leak, paint the leaky places with water glass, shellac, or spar varnish.



Assembling the condenser. The jacket is made from the barrel of a fly-spray gun. Inset shows how dents are made in inner glass tube

Stamps and Coins

YOU DON'T HAVE TO BE A COLLECTOR TO

THE other day, a friend of mine who is a lawyer came in with a canceled check. "I think this is a forgery," he said. "How about taking a squint at it with your spy-glass?"

So I dragged a microscope from its box, and we put that check through an optical third degree. The attorney believed that something like this had happened: A man had paid a bill with the check and, after the bank had canceled it by punching a lot of small, circular holes through the paper, he proceeded to erase the original payee's name and endorsement, and the date. Then, he wrote in another man's name, and offered the altered check as a receipt to prove that he had paid the money to that man as part settlement of an account. The attorney was seeking evidence to support this hypothesis.

The microscope showed us several interesting things. In places, the torn paper fibers indicated where the original

By
**MORTON C.
WALLING**

Used with color filters, your microscope can uncover flaws in stamps, like that shown by the photomicrographs of two Columbus stamps. The notch in the man's hat at the far right makes that issue worth five times as much as the perfect stamp beside it



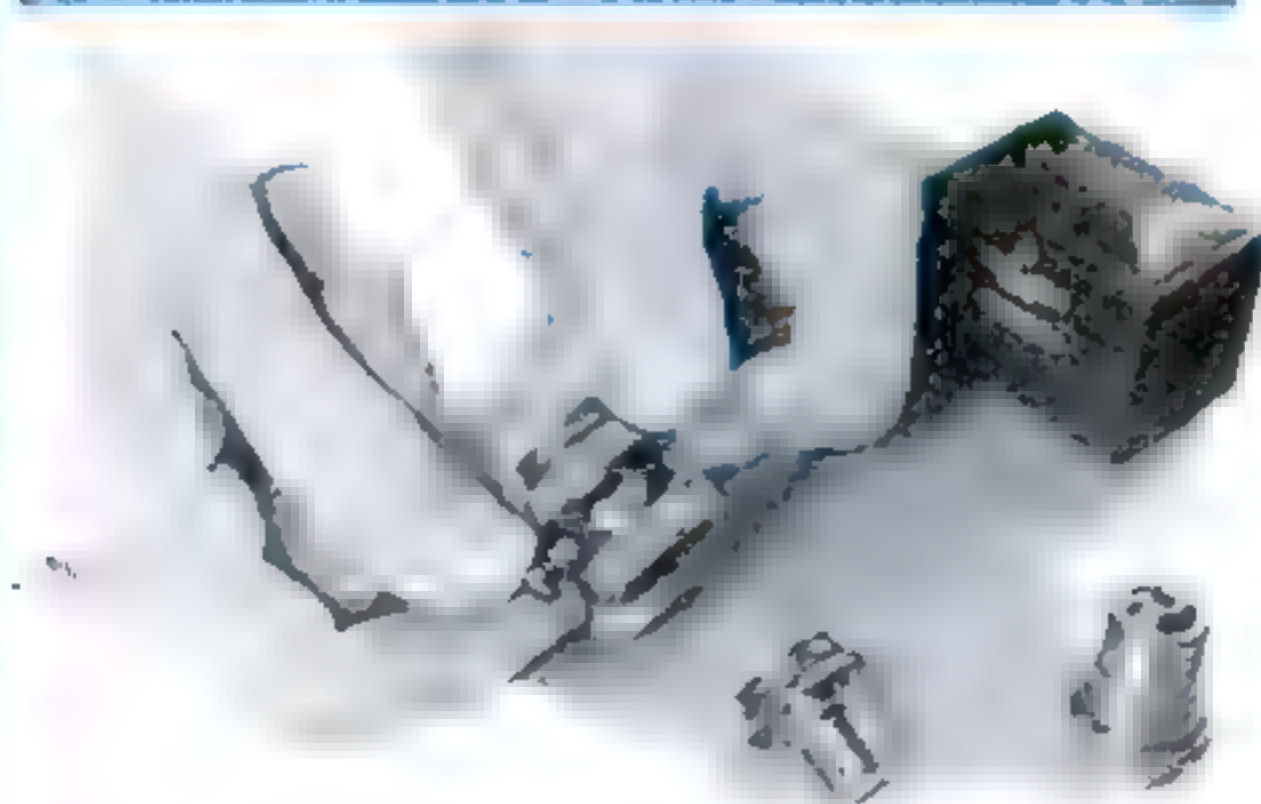
Under Your Microscope

LEARN THE SECRETS HIDDEN ON THEIR INTRICATE SURFACES

writing, which had been done in pencil, had been erased. Some one had written in the second man's name with a pencil also. The microscope revealed in places the original marks under the newer writing. At one or two points efforts had been made to cover up periods or dots, difficult to erase, by tracing over the pencil marks to make them heavier. The microscope showed the double lines, one above the other.

But the evidence that stood out most boldly was in some of the tiny holes punched by the bank in canceling the check. When the pencil crossed these holes in writing the new name, the lead made heavy deposits of graphite on one side of each hole; that is, the side last touched by the lead. Then, too, the microscope showed how some of the holes had deflected the pencil

A prism-type vertical illuminator being used with a standard microscope for examining coins. The attachments are shown below



A stamp on a letter is not news, but a letter on a stamp. . . Your microscope shows just that on a familiar U. S. special-delivery stamp. Oddly, it also shows that the letter bears no stamp

slightly, causing small changes in the direction of the line. One or two holes looked as if the pencil point had swung about the edge for nearly half the circumference, leaving a heavy graphite margin.

A few photomicrographs were made showing the defects, and these, particularly the ones of the holes and pencil deposits, enabled the attorney to leave feeling certain that he had a foolproof case.

But checks are not the only documents that can be explored by the microscope for profit or pleasure. Stamps, paper money, historic documents, autographs, coins, and medals, all lend themselves to microscopic study. But you don't have to be a collector of any sort in order to get a lot of fun out of the microscopic exploration of such material. You can spend several entertaining hours at your microscope, examining almost any of them.

Generally, the microscope is used at low or moderate power for such work, and the objects are examined almost entirely by reflected light as contrasted with transmitted light employed for examining thin sections.

Because of the low magnification—ten to twenty-five diameters being sufficient for much of the work—illumination is relatively simple. The check mentioned at the beginning of this article was, for example, examined with the aid of a small

photographic spotlight, placed so that its beam struck the paper at a point directly below the microscope objective lens, and at an angle of about forty-five degrees. There is sufficient working distance between most low-power objectives and the object to permit plenty of light from above to reach the area in the field of view.

Illumination also can be provided in a number of other ways. Simply placing the microscope near the window may do the trick. A small desk lamp, placed very near the stage, with its shade adjusted to keep light from shining upward into the eyes, is fine. Any of the commercial illuminators designed for use with opaque objects, including the vertical illuminator used by metallurgists, will serve excellently in most cases.

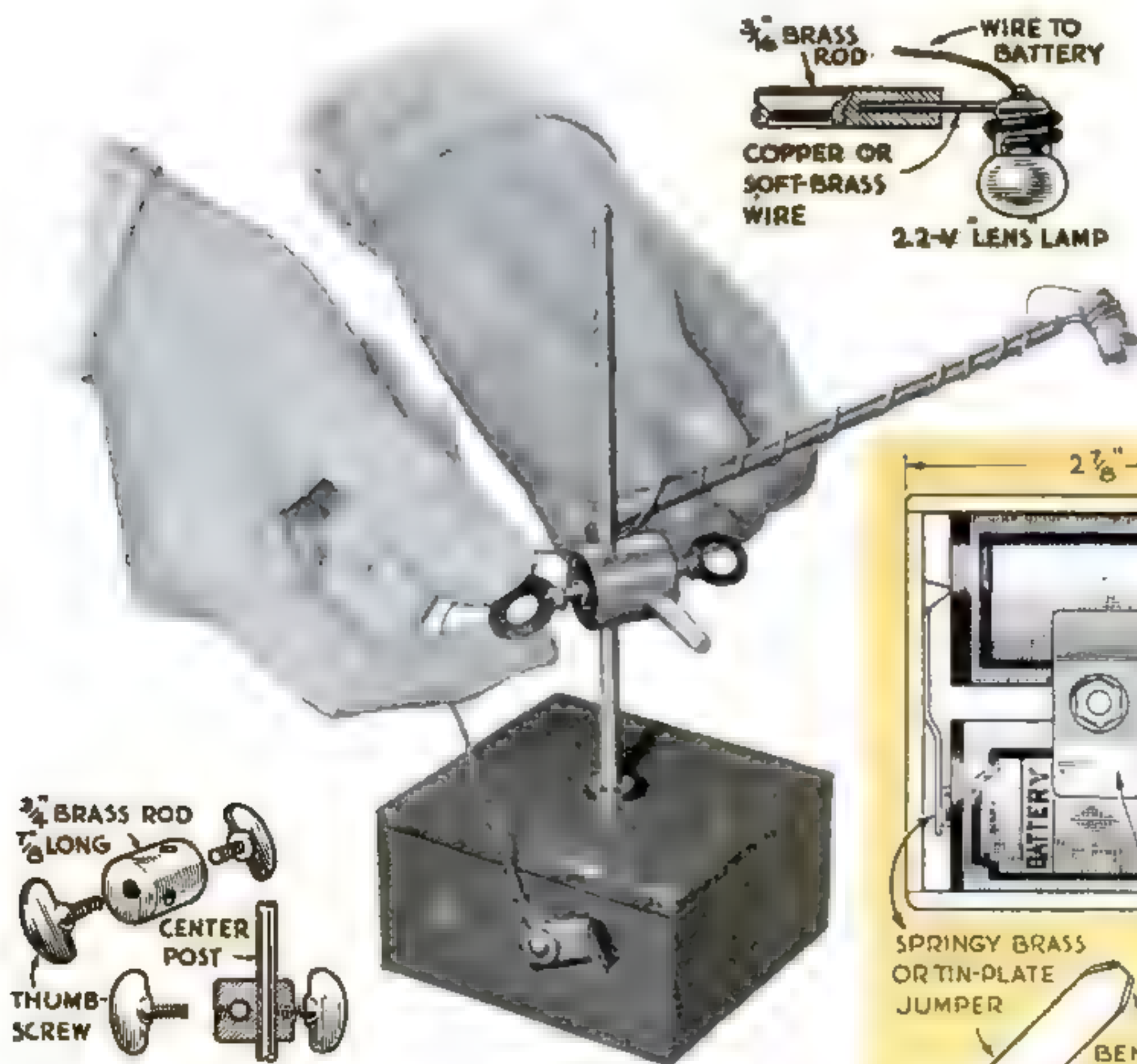
Much can be learned about a document, stamp, or coin with the aid of a simple hand lens or a tripod magnifier of seven and a half diameters. In fact, most stamp dealers carry several types of such simple microscopes. As for compound microscopes, the trouble most likely to be encountered is that their initial magnification is too great, although some of your exploring will be done at 100 diameters or even more. A binocular microscope of the Greenough type is excellent for low-power work, but this instrument

is not usually available outside of a laboratory.

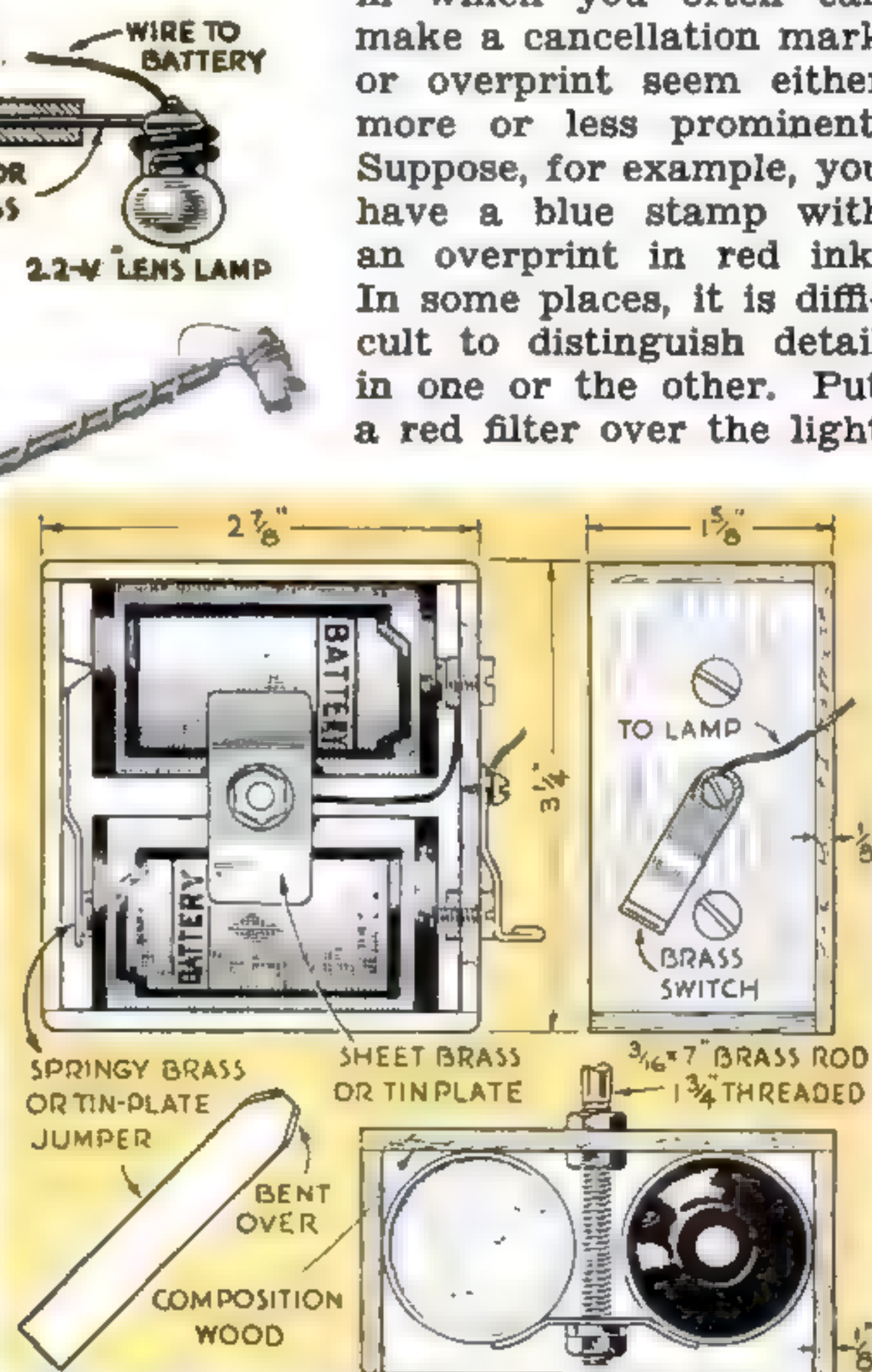
The stamp enthusiast who may not be a microscopist will find much of interest to observe with a compound microscope. Conversely, the microscopist who is not also a stamp collector can find much to fascinate him in the colored bits of paper. Low powers are useful in locating and studying characteristic marks and imperfections of the engraved image. These include such things as double, triple, or short transfers, recut lines, double impressions, and marks made by cracked plates. Perforations can be examined minutely, and if a micrometer eyepiece is available, they can be measured with maximum accuracy.

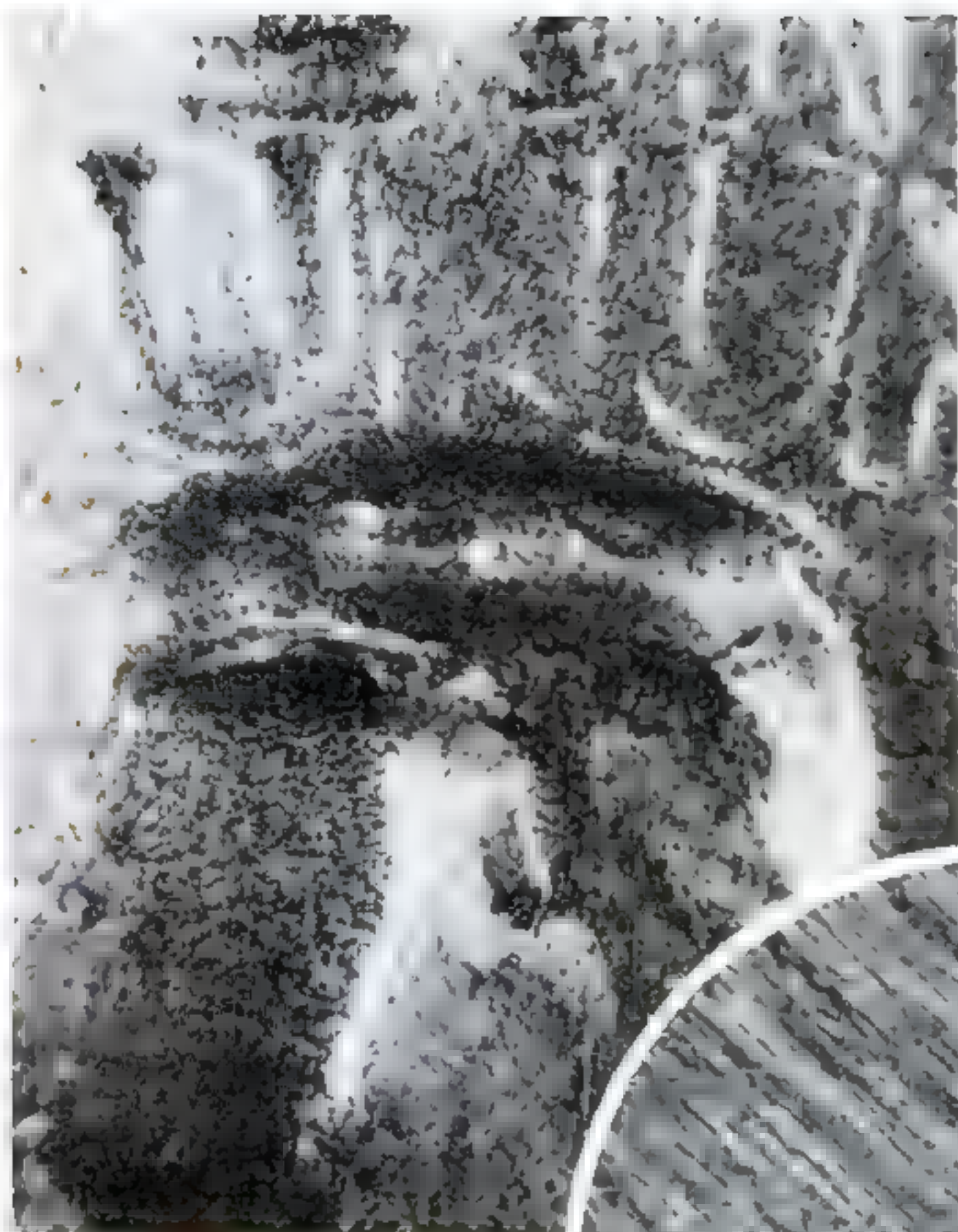
When you look at a stamp or other bit of printed matter through a microscope, say at fifty diameters, you quickly see that the ink is not as densely or evenly applied as it appears to the naked eye. Generally, only the tops of the individual fibers of the paper are colored, and often there seems to be more white space than dark in a line. Often you can distinguish clearly between the marks made by cancellation and by the original engraved plate. In this way, it sometimes is possible to tell what lies beneath a cancellation mark or overprint—printing that has been imposed on top of other printing.

There is another way in which you often can make a cancellation mark or overprint seem either more or less prominent. Suppose, for example, you have a blue stamp with an overprint in red ink. In some places, it is difficult to distinguish detail in one or the other. Put a red filter over the light



This easily made illuminator will let you aim light on your stage from any desired angle. A lens-type bulb concentrates the rays in a beam





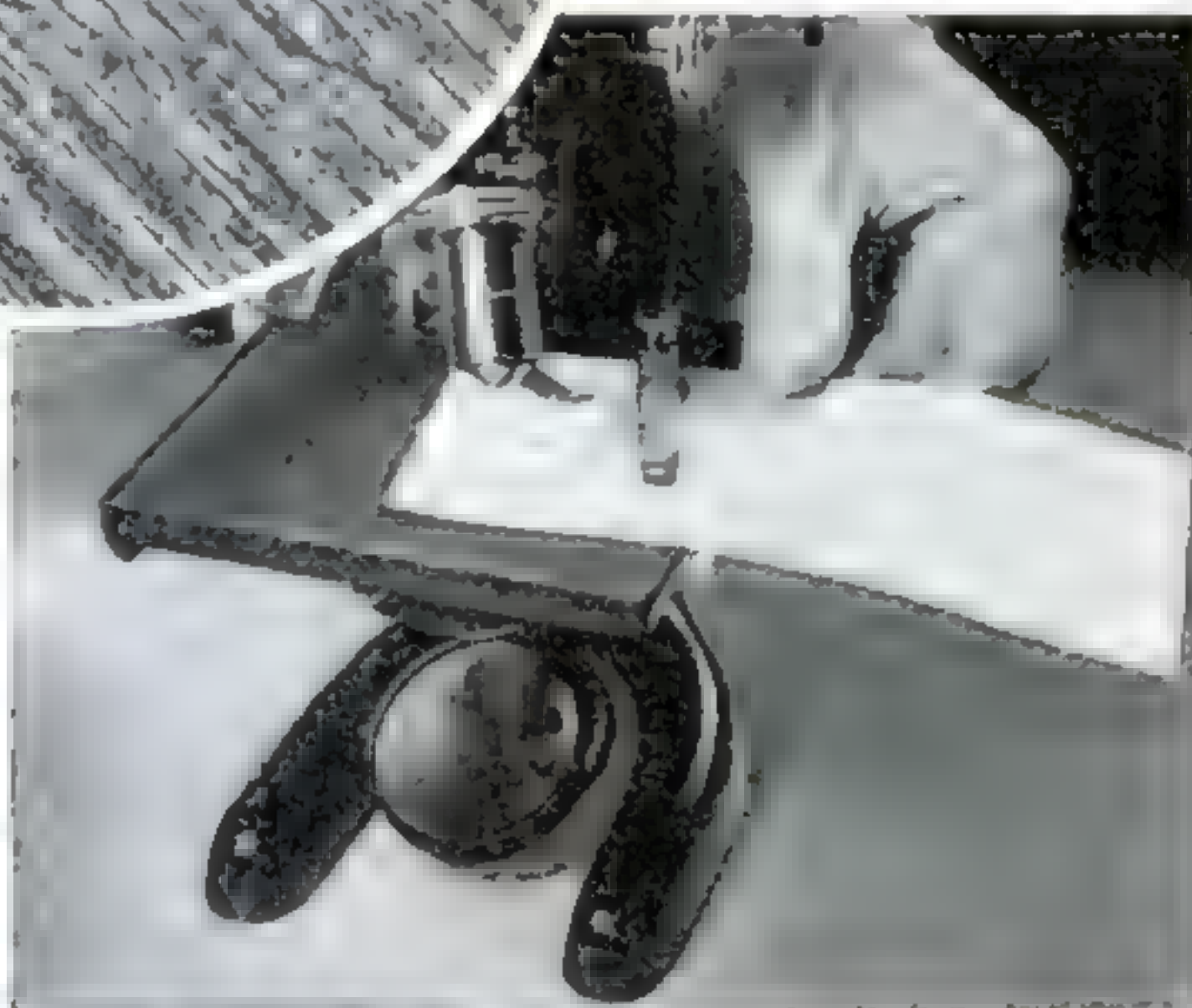
Eagle's head and part of the Latin inscription on a 1934 quarter, as revealed by low-power microscope

source being used to illuminate the stamp, and you will note a considerable change. The red overprint appears much dimmer, or may disappear entirely, while the blue lines of the stamp stand out more clearly, appearing black. Now substitute a blue filter, and the red overprint will appear black and very prominent, while the blue details of the stamp are subdued or erased entirely. Some experimentation with various filters may be necessary before the best color is discovered for working this seeming magic.

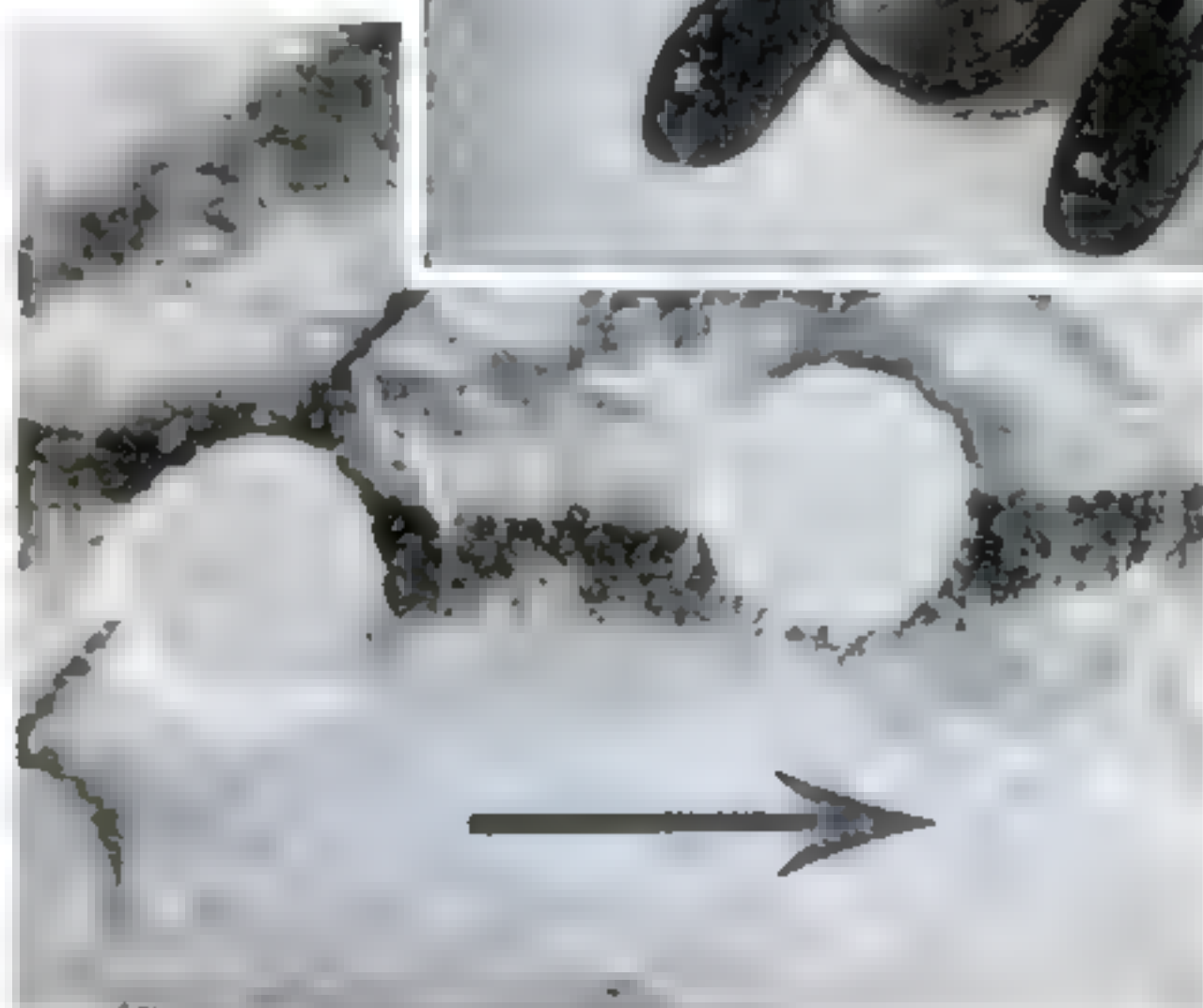
With your microscope set for a high magnification, say 200 diameters, you can study the various fibers used in the paper of the stamp or document.



Face of the quarter seen at 300 diameters, showing its texture



Studying a signature on back of a canceled check. The bank's perforations show pencil marks inside the holes, proving holes were cut out first, the endorsement forged later



You can identify fibers of cotton, silk, linen, and wood, provided of course you are familiar with the appearance of such fibers—a trick easily mastered simply by studying known samples for a time.

A fascinating game the stamp collector can play with the aid of a microscope is to find and study engraving-plate variations. That is, he can ferret out the tiny imperfections that distinguish one stamp from another that looks almost exactly like it—imperfections resulting from tiny flaws or differences in the plates from which the stamps were printed.

Here, for instance, is a five-cent United States stamp of the issue of 1932, bearing a picture of George Washington. A careful study with the microscope at, say,

fifteen diameters, reveals a fine line running through the T and upper part of the E of the last two words in "United States Postage," a line you hadn't noticed before when examining the stamp with your eye (*Continued on page 248*)



Turned by hand, the fan motor generates electricity

Simple Tests

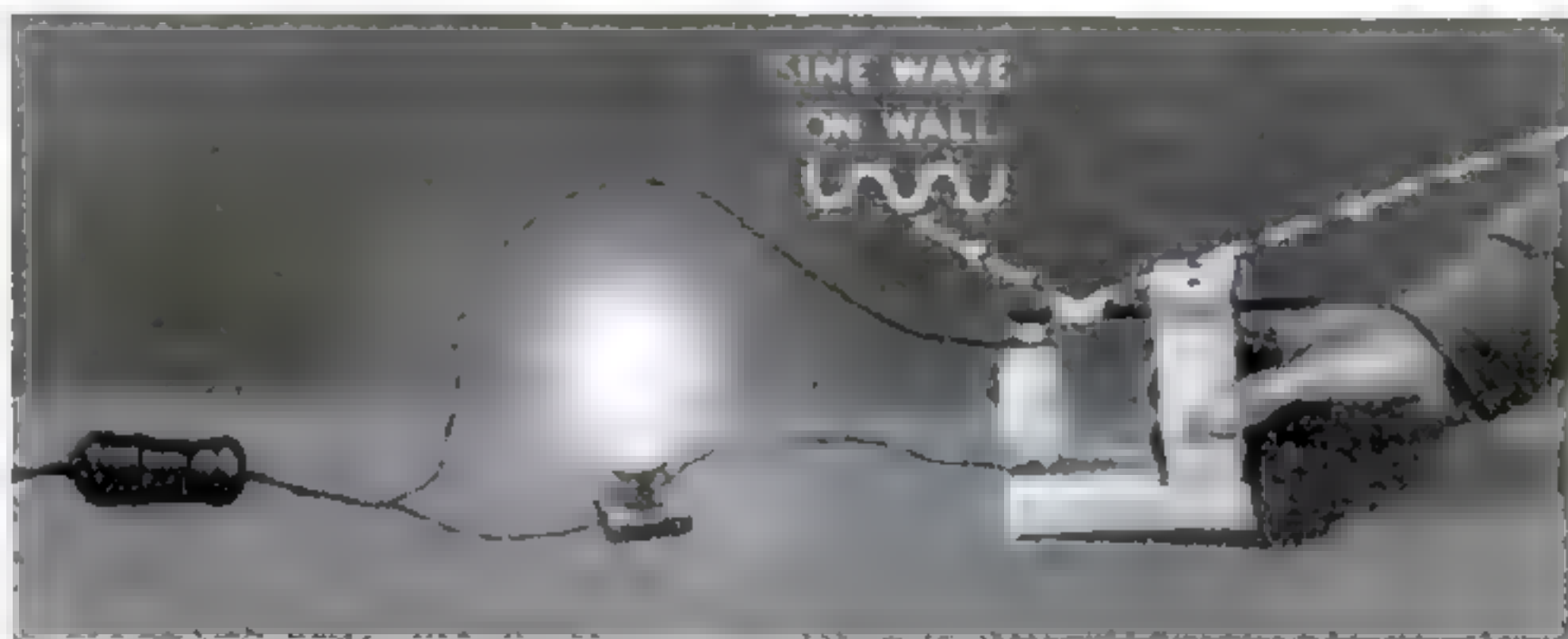
STRANGE NATURAL FORCES

TO SHOW that an electric motor can also act as a dynamo, connect a pair of radio headphones to the prongs of the connection plug of an electric fan, as illustrated in the photograph at the left. Then twirl the blades of the fan with your hand. You will hear crackling static in the earphones. The residual magnetism in the field of the fan motor produces lines of force that are cut by the windings of the armature, exactly as occurs when the driven rotor of an electric generator revolves in a magnetic field. Hence an electric current is produced. Flowing out through the wiring that ordinarily supplies the fan motor with current, the electricity produces the earphone static. Sometimes, the same machine is used interchangeably as a motor and as a generator, as in old-style automobiles.

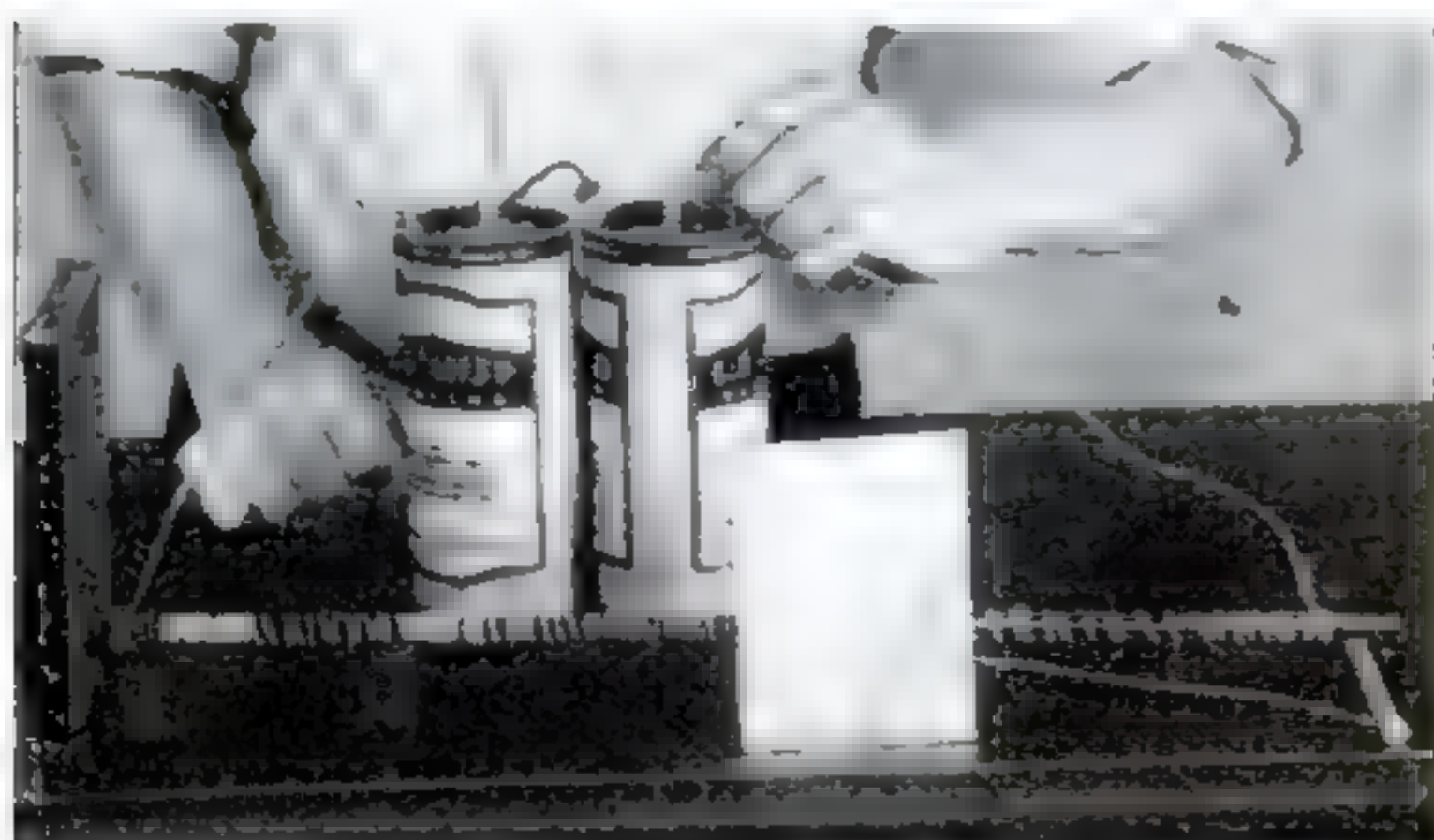
Light Beam Shows Waves of Alternating Current

MAKE a thick coil of fine wire around an iron core. Connect the coil and a lamp bulb to an alternating-current source as shown. Mount a hack-saw blade above the coil, leaving about three inches of it free to vibrate, and attach a small piece of mirror with a rubber band. Turn the device from side to side, while the mirror reflects a beam of sunlight, and you will see a wavy line of light on the opposite wall. It is the typical "sine wave" of alternating current, graphically representing its ebb and flow. Though the blade actually oscillates twice as many times a second as the

current, this does not alter the shape of the curve. If the hack-saw blade were magnetized, it would oscillate the same number of times a second as the current.



Wavy line traced by oscillating mirror charts ebb and flow of current



As the iron rod is magnetized, pointer shows expansion

Iron Changes in Length When Magnetized

WRAP an iron rod with fifty or more turns of heavy insulated wire. Rest one end upon a roller with a pointer attached. Connect the wire to a pair of dry cells. The magnetized rod will increase in length, as the turning pointer shows. Metals like iron, nickel, and cobalt sometimes lengthen and sometimes shrink in a magnetic field, depending on the kind of metal and strength of the field. The curious phenomenon is called the Joule effect.

Illustrate Laws of Physics

BROUGHT INTO PLAY IN EASY HOME EXPERIMENTS

Soapy Water Gives Bottled Sunset

A JAR of soapy water provides a fairly accurate color model of the atmosphere. Start with a rather weak soap solution. Sunlight or electric light viewed directly through the liquid will appear white or yellow, like the sun itself. From the side, the solution will appear blue like the sky. It scatters the short blue light waves, just as dust particles in the air affect sunlight. Now add more and more soap. As you look through the solution, the color of the light it transmits will change to yellow, then orange, and then red—just as the sun takes on these colors as it sinks lower and its rays pass through a greater thickness of the



The thicker the soap solution, the redder the light appears in it

atmosphere. When viewed from the side, however, the solution still looks blue, just as the twilight sky retains its blue color under reflected light from the setting sun.

Spoon Illustrates Action of Airplane Wings

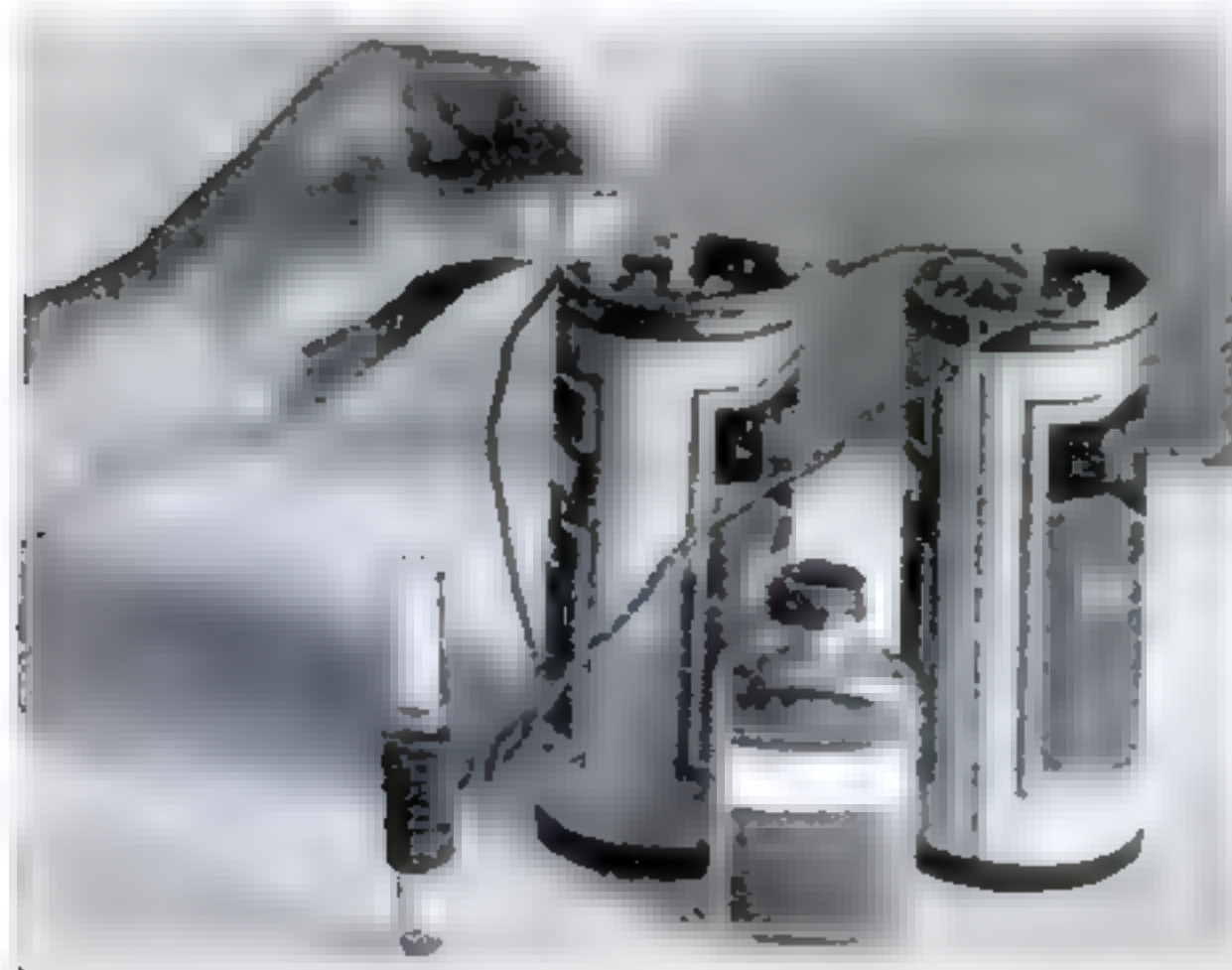
BRING the back of a teaspoon up to a stream of water flowing rapidly from a faucet. You will feel the spoon sucked into the stream, until most of its back is covered. This is due to the partial vacuum produced as water drops away from the lower part of the spoon's curved back. An airplane wing behaves similarly, and suction resulting from the flow of air over its curved back accounts for a large proportion of its lift. The remaining lift is due to air pressure on its lower surface.



Running water sucks the spoon bowl into the stream

Cloudy Liquid Cleared Up by Magnetic Current

OBTAIN some powdered magnetite, a magnetic ore of iron, and place a tiny pinch of the mineral in a test tube of water. The gray-colored suspension that is formed when the particles mix with the water will be only partly transparent to light. Now try the effect of subjecting the contents of the test tube to a magnetic field, by passing current from two or more dry cells through a coil of wire surrounding the tube. As soon as the connection is made, the magnetic particles will "line up" and allow more light to pass through the suspension, making the liquid appear clearer.



Current passes through a coil around the tube

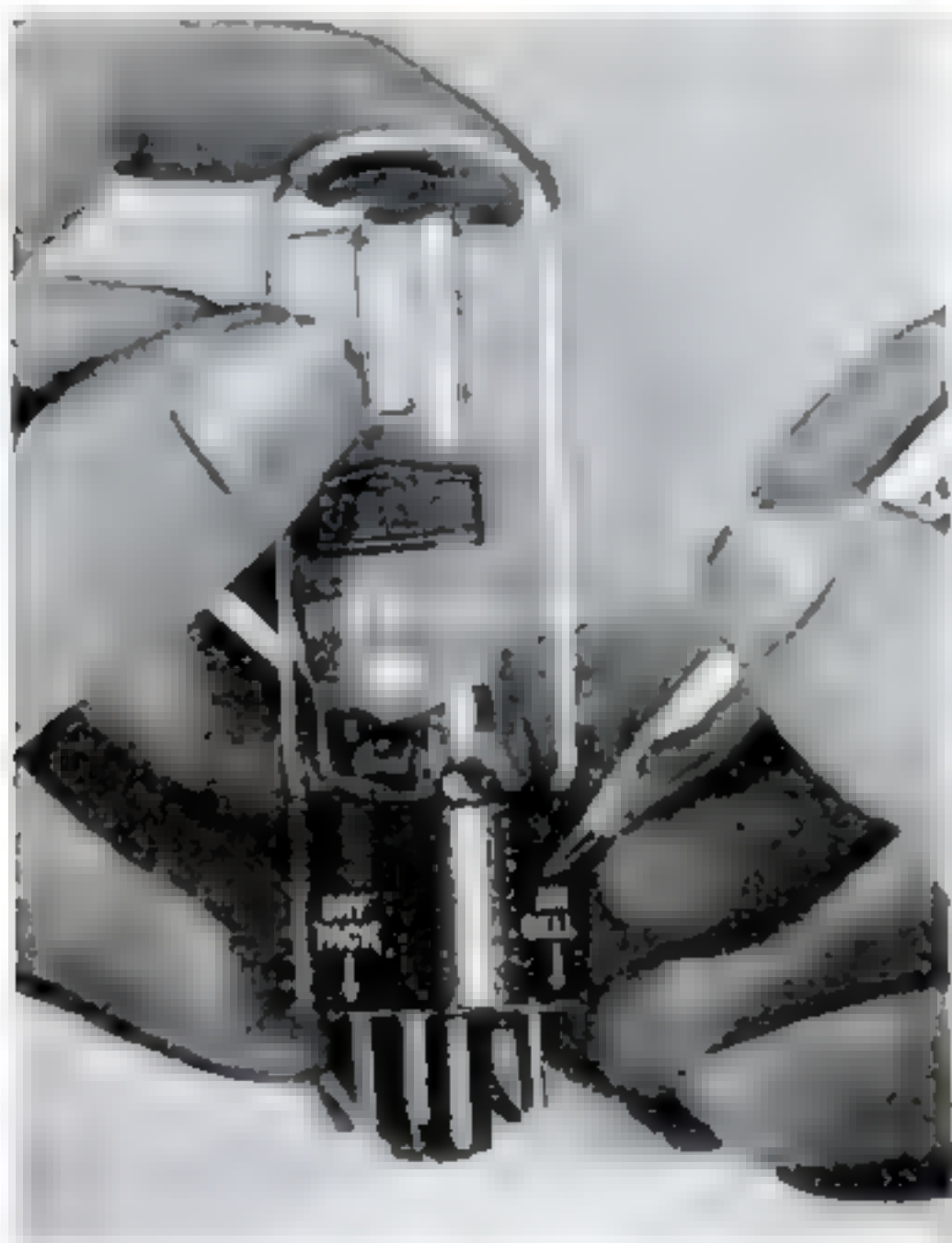
New Wrinkles



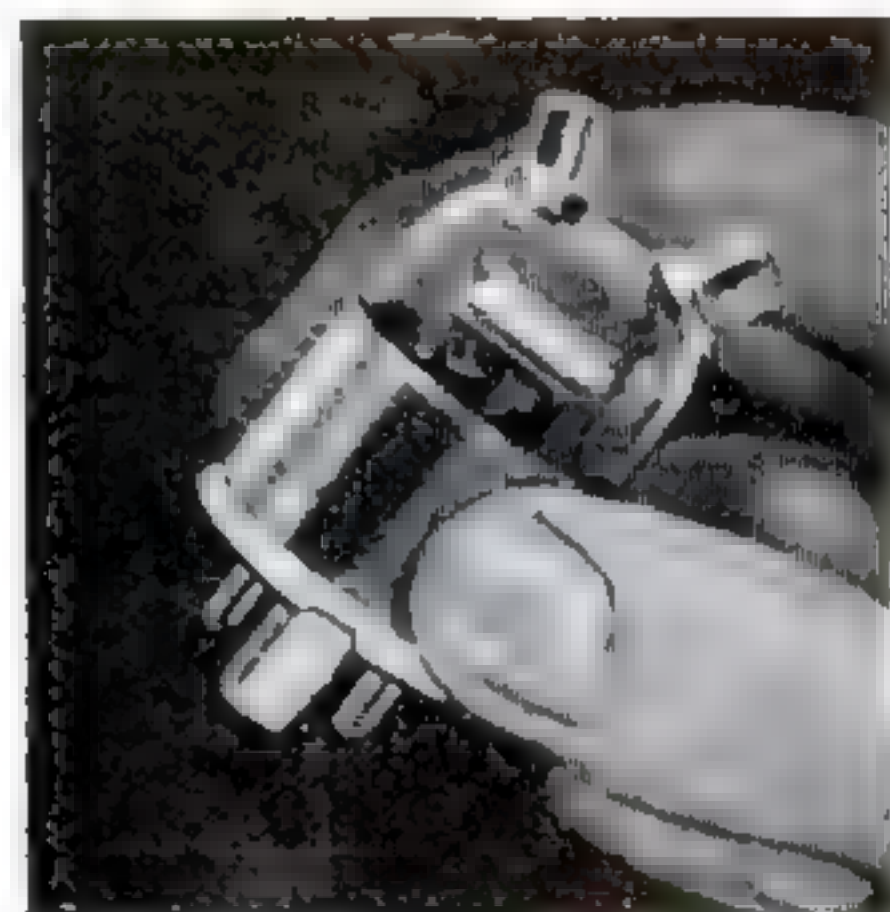
This kit contains complete materials for assembling a small transmitter

PACKED in kit form, a tiny 25-watt crystal-controlled transmitting set, complete even to its own power supply, is now available for amateurs to assemble at home. The diminutive outfit is designed to use a doublet antenna, which is both simple and economical to erect. Because of the circuit employed, only one crystal is required for operating on several different frequency bands. If at any future time the amateur wants to increase the power of his station, the unit, which is illustrated in the photograph at the left, can be used as an exciter stage in connection with a 100-watt radio-frequency stage.

New Midget Transmitter Tube



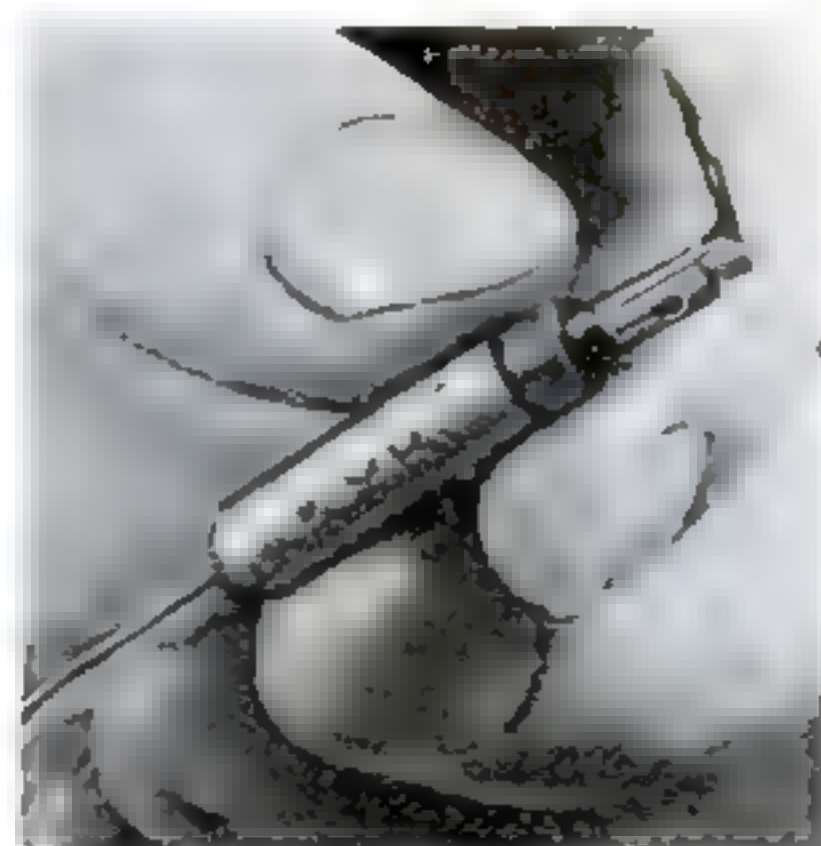
DESIGNED especially for use as an ultra-high-frequency oscillator, radio-frequency amplifier, or detector, in transmitters operating on frequencies around five or ten meters, a new midget tube features short connection leads, small internal elements, and low interelectrode capacities to give efficient operation. The tube's plate and grid leads terminate in caps in the dome of the glass bulb.



Leads end in caps on the bulb

Voltage Adjuster for Battery Sets

WITH a new universal ballast-resistance tube, two-volt battery receivers can be powered by almost any type of battery supply simply by making different connections to the tube's base prongs. One set of prongs is for a two-volt storage cell, another for a 2½-volt air cell, and a third for a three-volt dry-cell hook-up.



This unit offsets fluctuations in condensers caused by heat

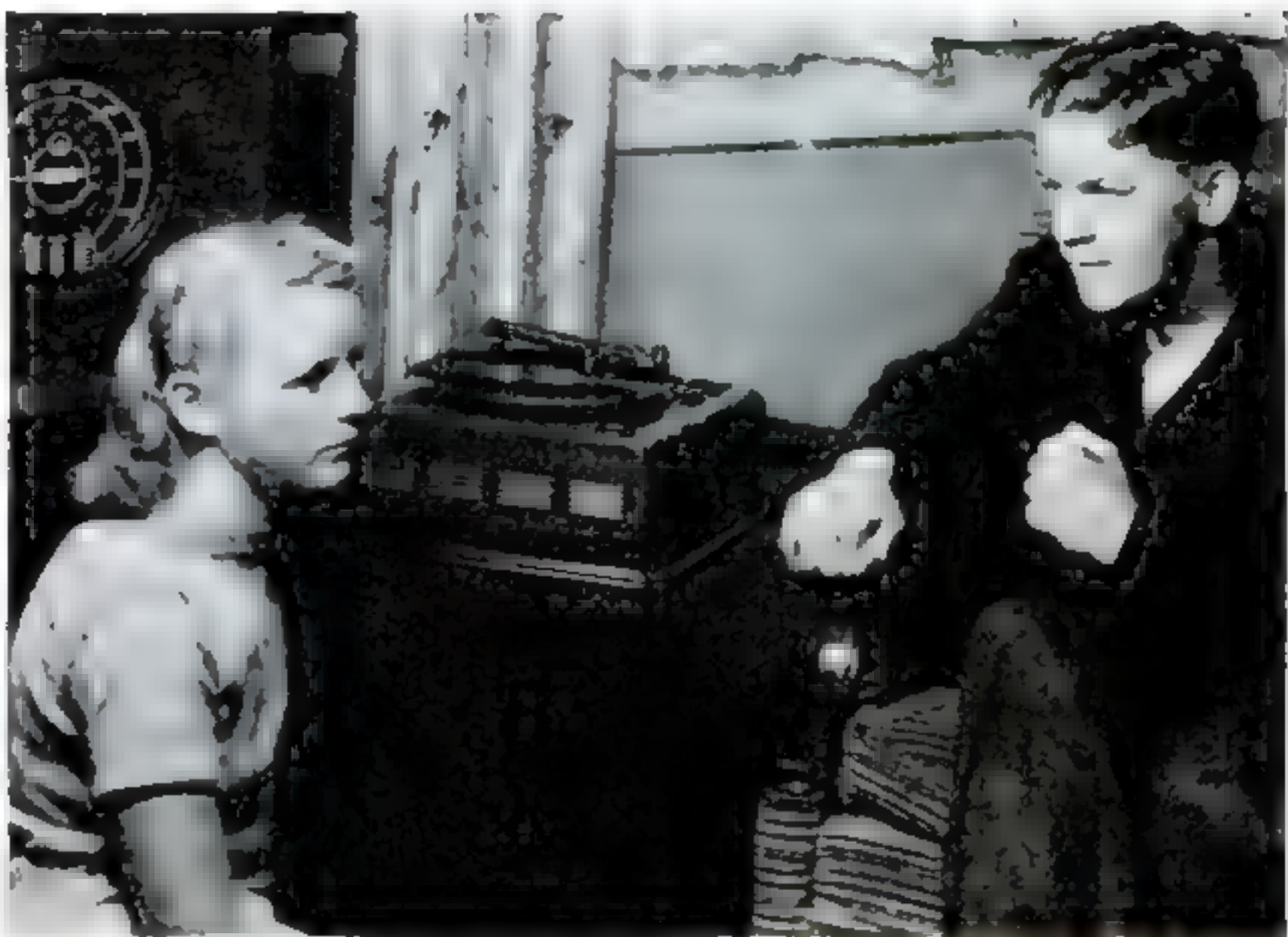
Liquid Compensating Condenser

FREQUENCY drift in broadcast receivers, which often results in annoying dial-setting changes, and is caused by room-temperature fluctuations, can be controlled with a new liquid compensating condenser. Connected in parallel with the tuning condensers of a set, the unit's capacity decreases as temperature rises, to offset automatically the increase in the capacities of the tuning condensers. The device is shown at left.

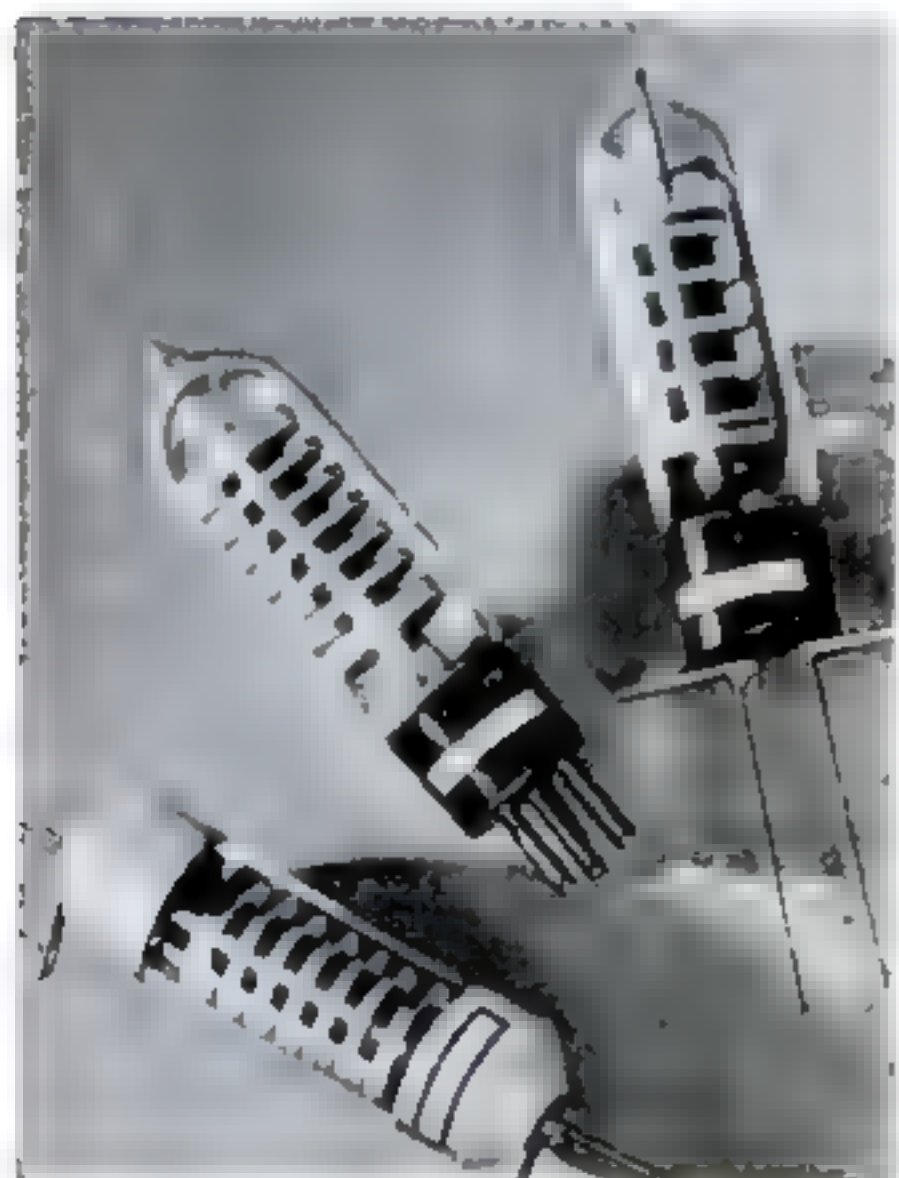
in the World of Radio

Record Player Needs No Connection to Set

NO CONNECTING wires to the radio receiver are needed with a new type of electric phonograph. The radio is simply switched on and tuned to an unused broadcast wave length and then the pick-up unit is plugged into any convenient outlet anywhere in the house, the electric supply line being utilized to hook up the record player with the radio set. When atmospheric conditions cause troublesome static, a wire from the radio antenna post need only be placed near the record-player line cord.



New record player in use. It is merely plugged into an outlet

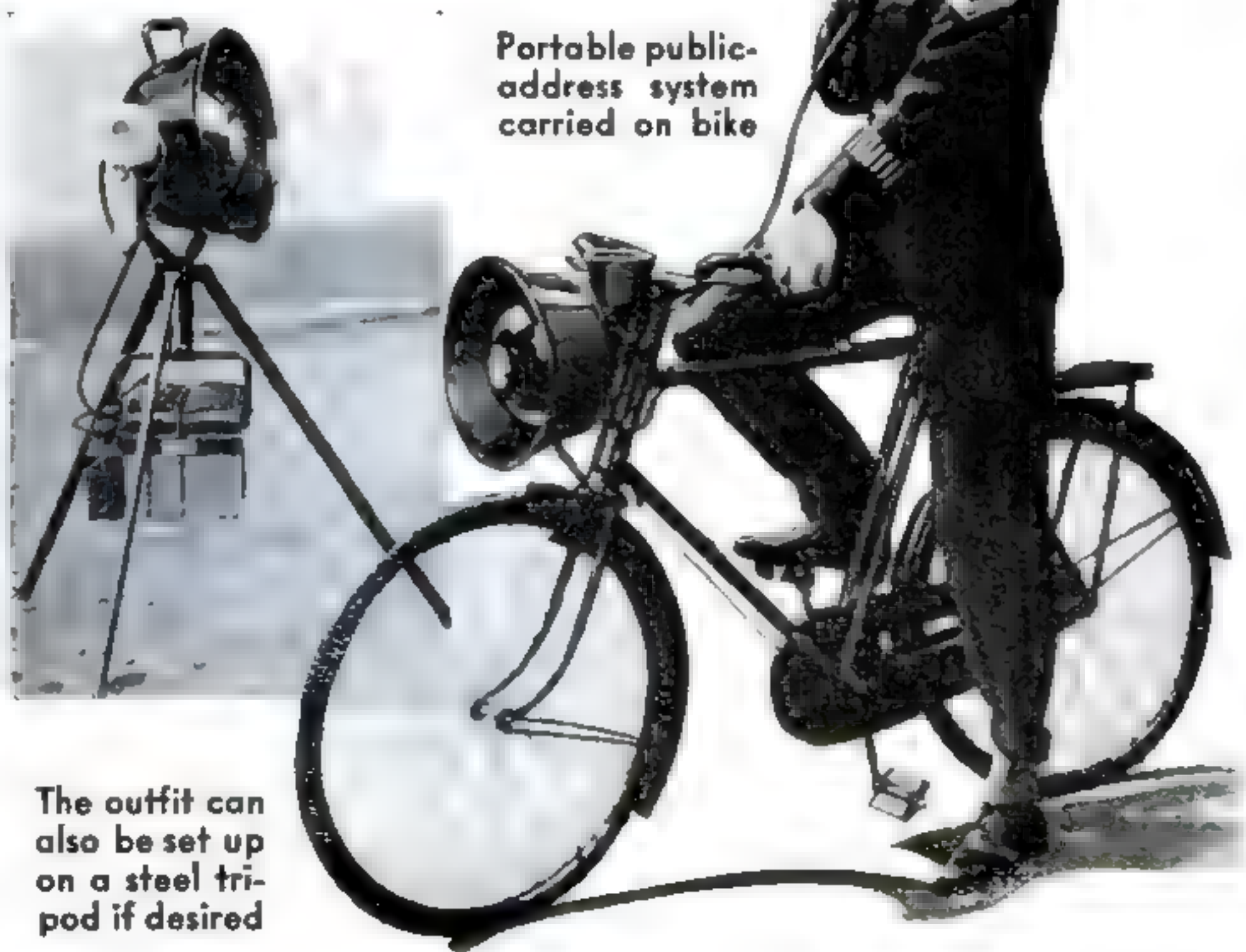


Sealed Resistors Resist Humidity

TO PROTECT them from the effects of extreme heat, humidity, salt air, or other atmospheric conditions, precision resistance units now available to set builders are hermetically sealed within transparent tubes. Made in resistances ranging from .1 ohm to 2 megohms, the units have withstood repeated transferring from boiling water to ice water. The resistors may be obtained with soldering lugs and wire terminals, or with tube-type bases.

Bicycle Carries Loudspeaker System

EXCEPTIONALLY light and compact, a loudspeaker system now marketed by a British firm is being used extensively by bicycle police in England for handling large crowds and directing traffic. Consisting of a special weatherproof loudspeaker and a hand-type microphone, the portable equipment works without an amplifying unit. When mounted on a bicycle, the only additional equipment necessary to operate it are two motor-cycle-type storage batteries which are carried on the luggage rack above the rear wheel. If desired, the unit may be mounted on a steel tripod for use on roofs of buildings and other vantage points.



Portable public-address system carried on bike

The outfit can also be set up on a steel tripod if desired

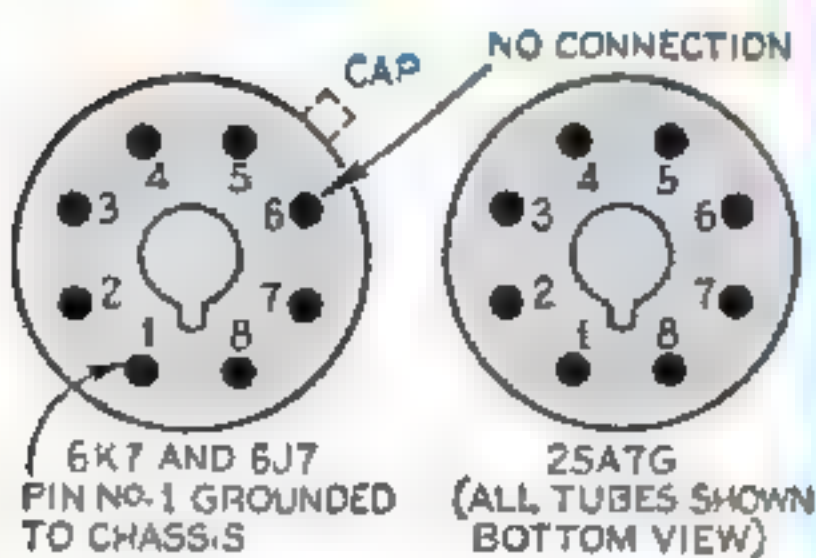
KITCHEN RADIO

RESEMBLES FLOUR CONTAINER

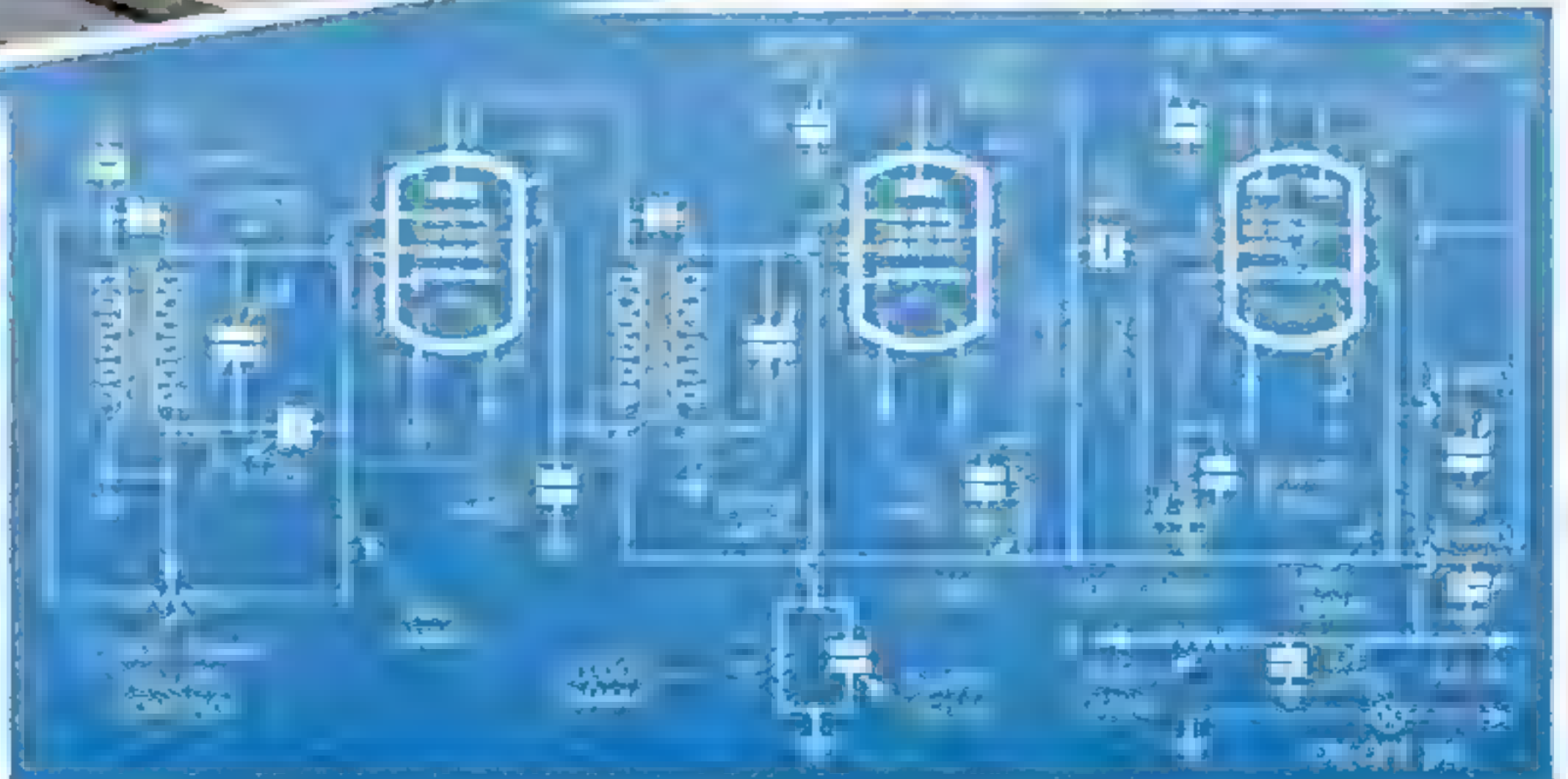


Matching kitchen bins, the radio is both decorative and handy. The lettering and trim are in black on an ivory background

By
ARTHUR C. MILLER



Follow the numbers in the circuit diagram for making the tube-base connections



DESIGNED specially for use in a kitchen or kitchenette, this compact three-tube broadcast receiver is built to match the conventional canisters used by housewives to store flour, sugar, and other dry groceries. Operating on either alternating or direct current, the set can be plugged into any house-wiring outlet and requires only a short antenna and no ground.

To match the set of canisters already in the writer's kitchen, the wooden receiver cabinet was finished in ivory enamel with black lettering and trim. The word "FLOUR," which appears on the front just above the tuning dial, was painted on free-hand. However, if the reader prefers, he may cut the letters from a strip of black electrician's tape, and then press each letter in place. As electrician's tape is already adhesive, no glue will be required. Black paper letters, available at most large stationery or art-supply stores, also can be used, if desired.

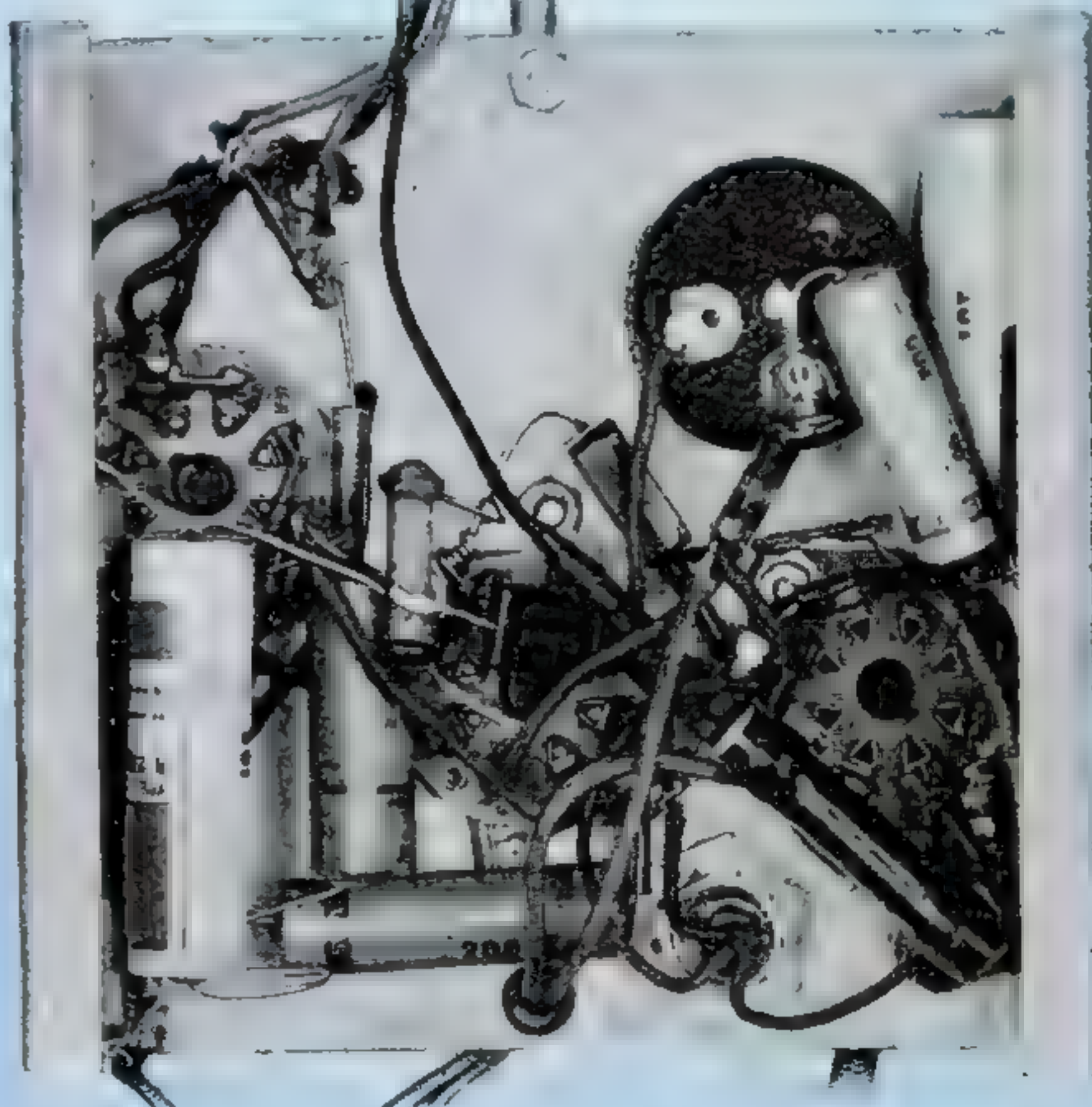
Since most kitchen containers have some sort of handle on the top, the writer placed the volume control on the top of the cabinet. The knob makes the general appearance of the receiver more realistic. The speaker was mounted on the right side in order to leave room on the front for the word "FLOUR."

In designing the circuit, one of the new ultra-midget combined pentode and rectifier tubes was chosen as a combination rectifier and power tube to save space and make the chassis as compact as possible.

Two all-metal tubes are used in the radio-frequency and detector stages and are coupled through shielded iron-core coils. This provides maximum efficiency and results in an increase in sensitivity with the result that a greater number of stations can be heard with this set than with most standard A.C.-D.C.



Note the arrangement of the tubes, coils, and condenser on top the chassis



This bottom view of the chassis will aid you in wiring the set

tuned-radio-frequency receivers. Adequate filtering in the plate circuit of the detector tube avoids instability caused by feed-back between the audio and detector stages.

The chassis, which can be cut and bent to shape easily from sheet aluminum, measures 1½" by 5" by 5½". The front and back should be left open to provide ventilation for the 2,500-ohm filter resistor. In order to provide plenty of room for mounting the resistors and by-pass condensers, the dual electrolytic condenser should be placed above the chassis. As shown in the photographs, it will fit under the output transformer of the five-inch, permanent-magnet loudspeaker. Before installing the speaker, a piece of metallic cloth, which can be obtained from a radio-supply house, should be cut to shape and glued over the speaker opening on the inside surface of the cabinet.

As with all radio circuits, caution should be exercised in making the various connections, particularly those to the tube sockets. Remember that filament voltages are low, plate and grid voltages are high by comparison, and that one slip may destroy a radio tube. All connections should be made carefully with solder, and connecting wires should be made

LIST OF PARTS

Tuning condenser, two-gang, .00036 mfd.	Resistor, 2,500 ohm, 10 watt.
Tubular condensers (three), .1 mfd.	Resistor, 400 ohm, 1 watt.
Tubular condenser, .05 mfd.	Half-watt resistors, ½ meg., 20,000 ohm, 2 meg., 200,000 ohm, and 300 ohm.
Tubular condenser, .01 mfd.	Antenna and radio-frequency coils, shielded, iron-core.
Fixed condenser, mica, .002 mfd.	Volume control and switch, 15,000 ohms.
Fixed condenser, mica, .001 mfd.	Radio-frequency plate choke, shielded, 30 mh.
Fixed condenser, mica, .00025 mfd.	Miscellaneous—Mid-get wafer 8-prong sockets, tubes (see diagram), speaker.
Electrolytic condensers, 50 volt, 5 mfd.; ultramidget, ultrathin, 8 and 8; and 50 volt, 10 mfd.	
Line-cord resistor, 280 ohms.	

as short as possible to insure low losses and good performance.

The reader will find that the wiring of the tubes will be greatly simplified if he will compare the numbering of the terminals on the tube-socket diagrams with those appearing in the circuit diagram.

In operating the receiver, thirty or forty feet of flexible insulated wire strung around the molding or baseboard will provide good reception. As with all A.C.-D.C. receivers, no ground connection should be used, since the circuit is already grounded through the power plug.



Putting finishing touches on the cabinet. At the right is a rear view of the completed set. The knob on the top is the receiver's volume control



Beginner's Battery Receiver

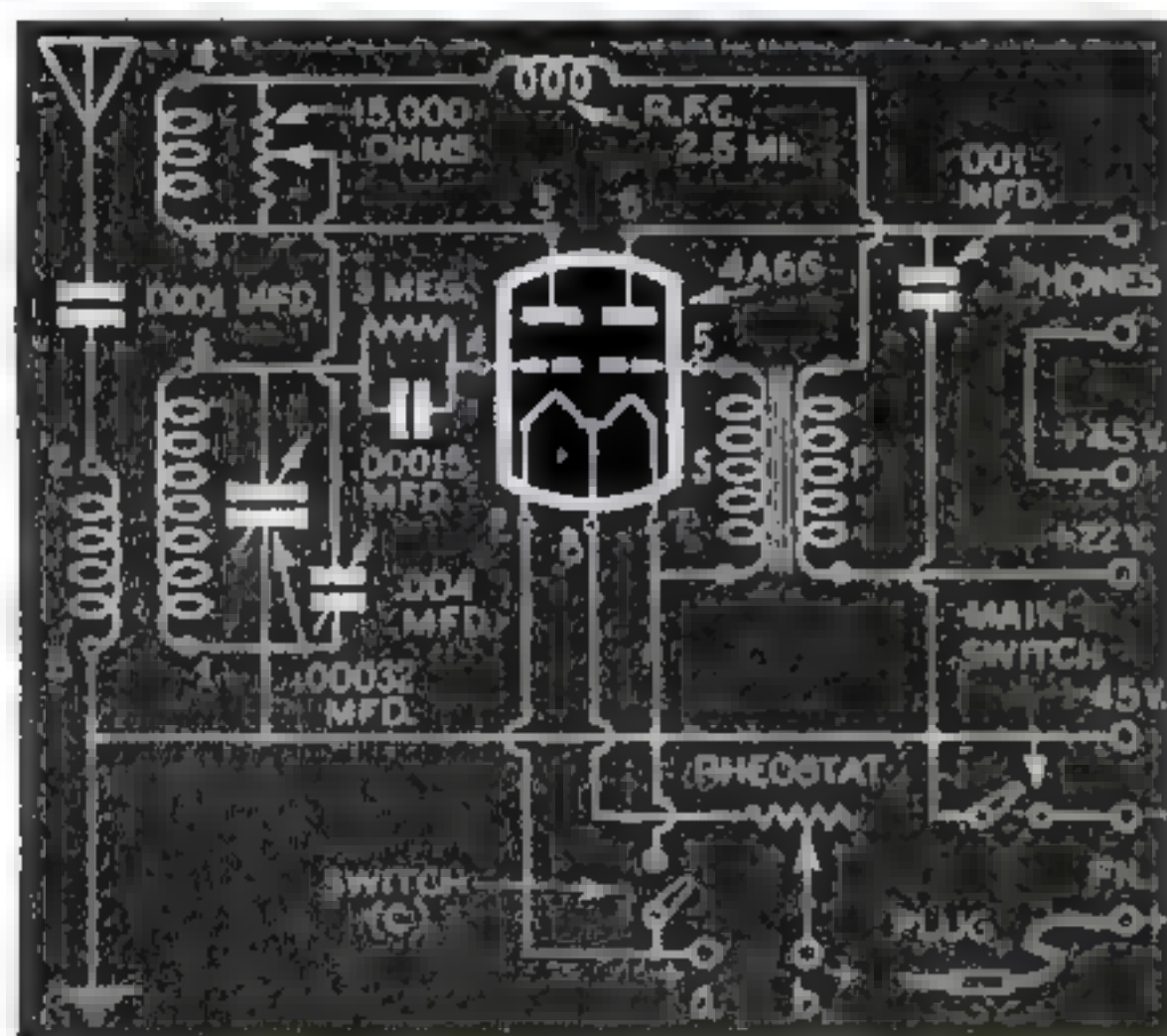
COSTS LITTLE AND IS EASY TO BUILD



WHETHER you've built lots of radios or none at all, the construction of this efficient broadcast-band battery receiver should cause you little difficulty. It was designed especially for beginners, and uses a new tube having an ingenious heater arrangement that makes it possible to connect the filaments either in series or in parallel.

Primarily designed as an output tube in a class-B battery amplifier, the 4A6G, as the new tube is called, also may be used with excellent results as a two-tube broadcast receiver. In this circuit, one of the two triodes inside the tube is used as a regenerative detector, and the other as an amplifier. Transformer coupling was chosen instead of resistance coupling because of the greater amplification possible.

The most interesting part of the circuit is the switching and plug-in arrangement which makes it possible to connect the filaments of the 4A6G tube either in series or in parallel. This allows you to operate the receiver with almost any type of "A" battery supply—a 2-volt storage battery, a 4½-volt storage battery, an air-cell battery, or two or three dry cells, whichever may *(Continued on page 252)*



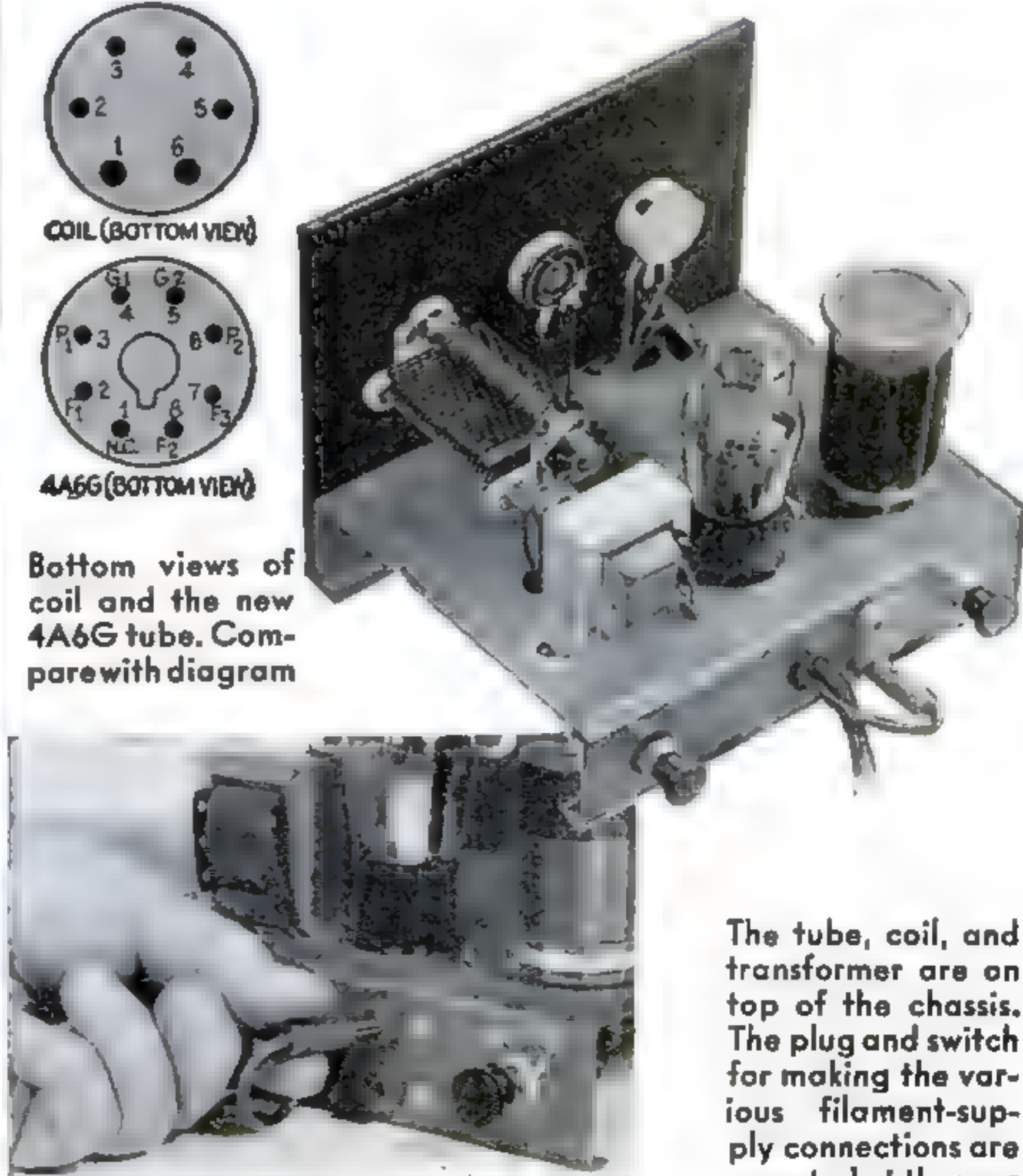
Study the plug and rheostat connections to the tube carefully before wiring the set



Bottom views of coil and the new 4A6G tube. Compare with diagram



How the wiring is arranged under the chassis. All connections must be well soldered

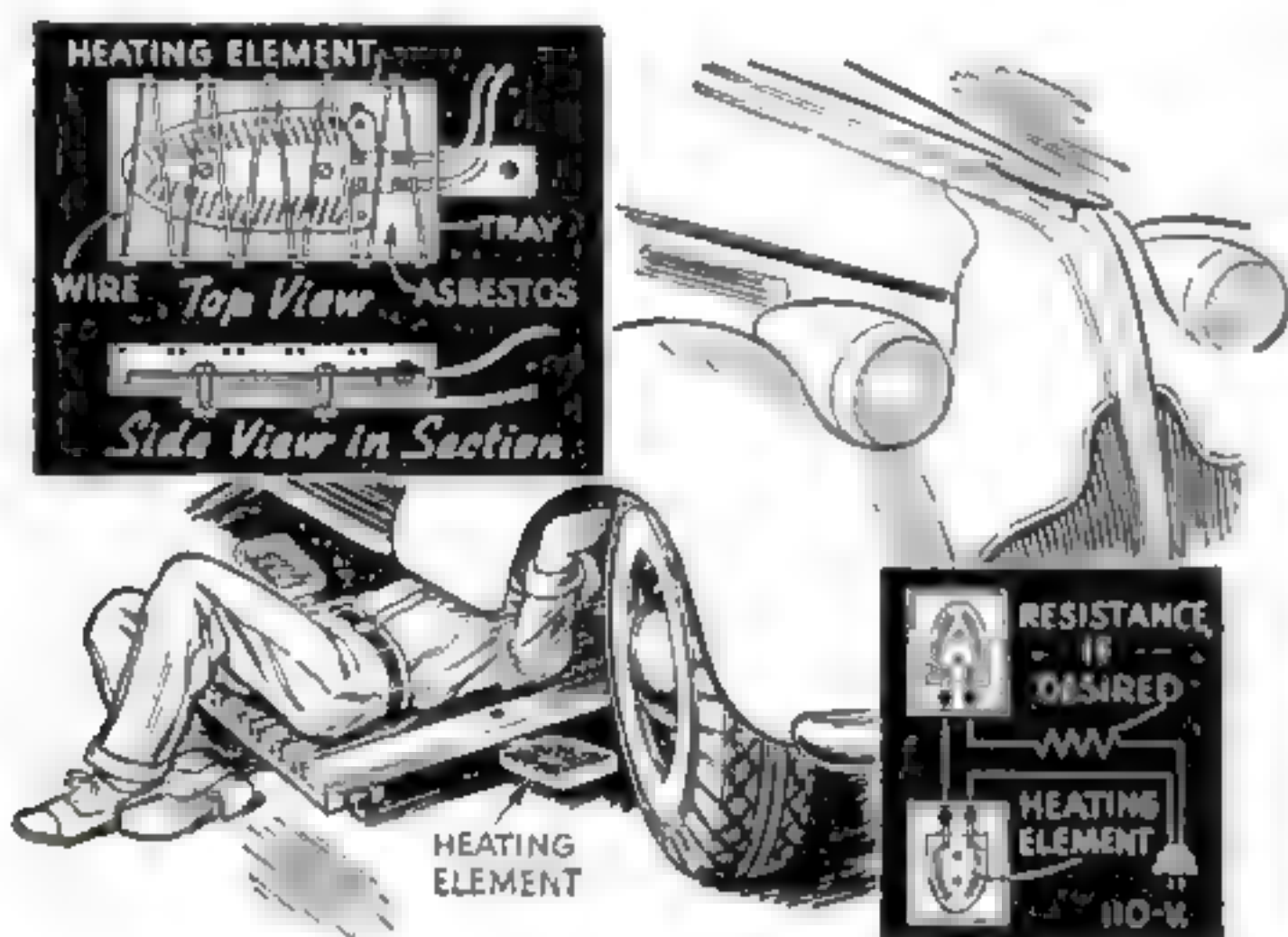


The tube, coil, and transformer are on top of the chassis. The plug and switch for making the various filament-supply connections are mounted at the rear

Tricks for Motorists

Slide Makes Luggage Compartment Easier To Load

DEEP automobile luggage compartments are easy to load or unload with the home-made sliding rack pictured at the right. A board about as wide as the compartment and half as deep is fitted with small casters, permitting it to slide back and forth. A narrow strip of wood nailed to the rear edge of the board serves as a stop. Reaching and stretching is thus eliminated by first loading the board, sliding it all the way back inside the compartment, and then packing the cleared space left unencumbered after the slide is out of the way.—A.H.W.

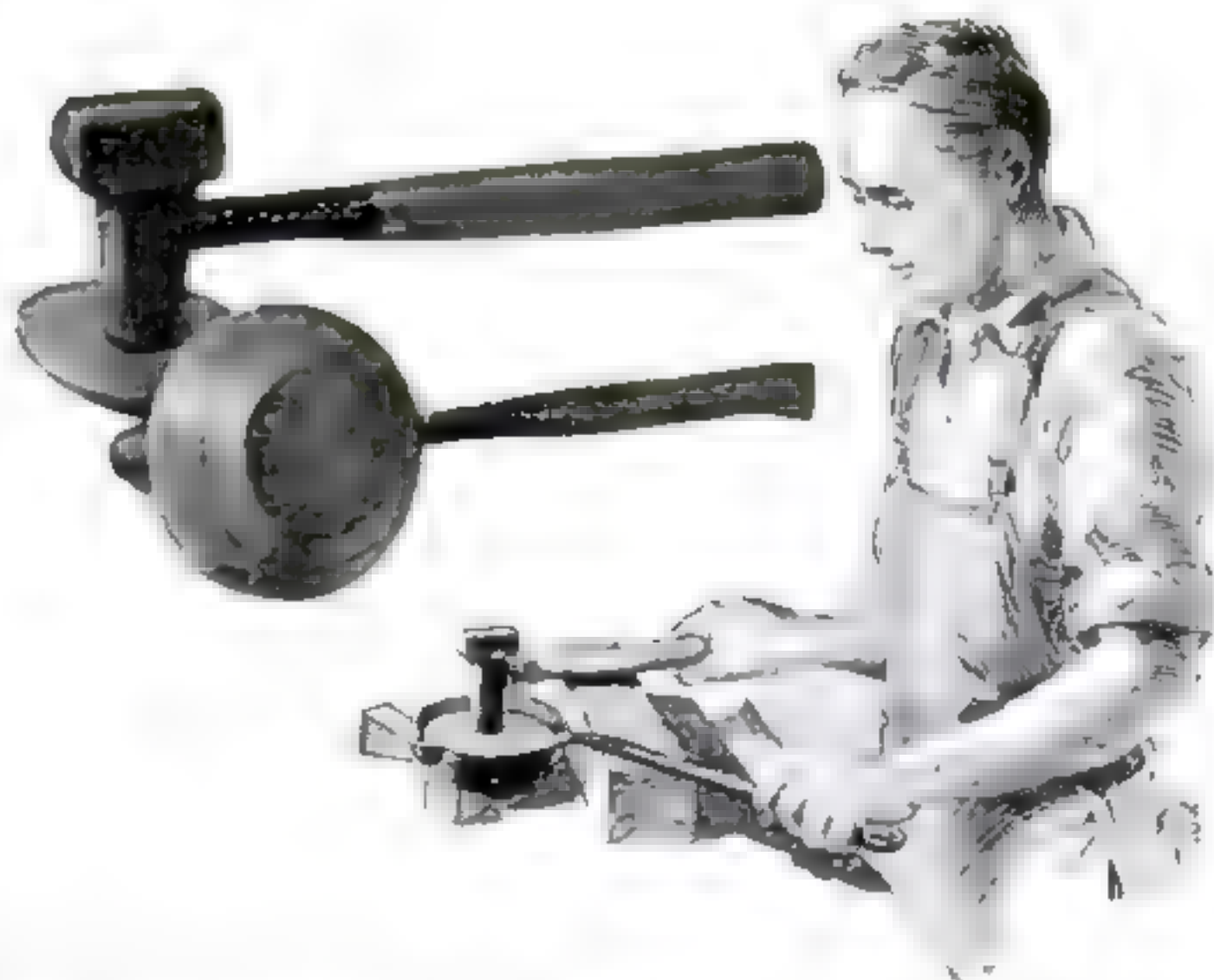


Heater for Repair Creeper Keeps Mechanic Warm

AUTOMOBILE mechanics working for long periods on a creeper underneath a car often suffer discomfort and sometimes catch colds because of the damp, cold concrete floor directly beneath them. Diagrams reproduced above show how a twin heating unit can be attached to a creeper to keep the mechanic warm during prolonged work under a car. The heaters consist of electric-iron elements mounted in asbestos-lined trays and connected in series so that each operates safely on half the normal voltage of the electric supply to which they are wired. An extra resistance element may be added to the circuit if desired.—W.C.W.

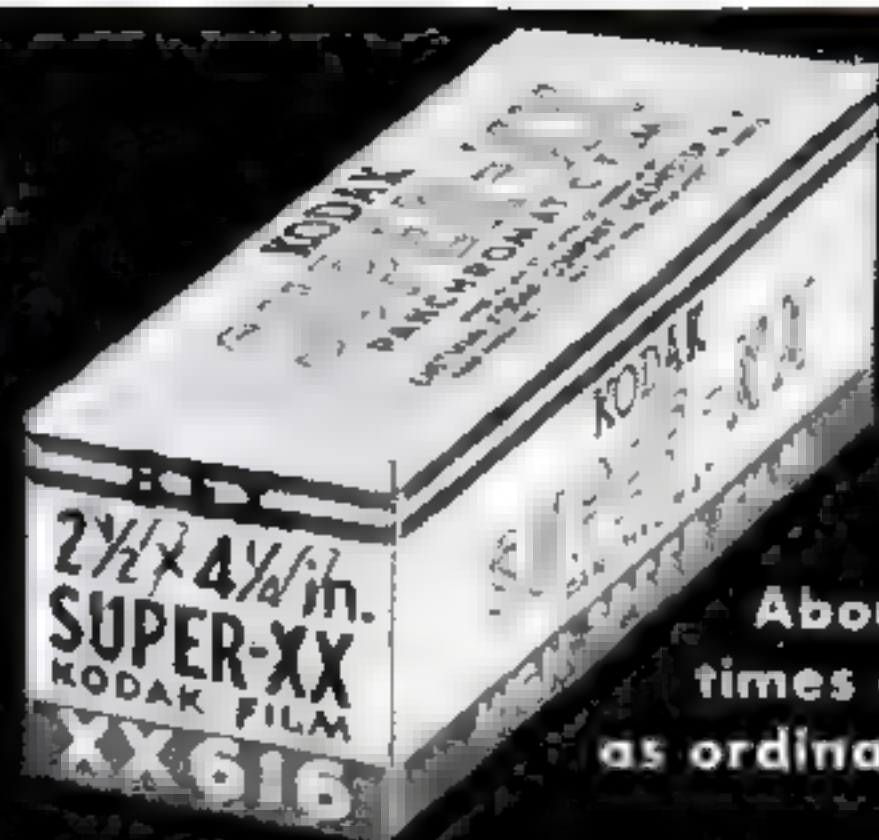
Converting Old Hammers into Handy Fender Tools

OLD discarded hammers can be converted into valuable fender tools at little or no cost by providing them with large dome-shaped heads of lead. Simply melt up the lead from two old car batteries in a ladle or other cup-shaped container. Then immerse the hammer head in the molten lead so that it is close to but not on the bottom. Lead and hammer are then allowed to cool, care being taken that they are not disturbed meanwhile. When cool, the tool is ready for use in fender repairs.—C.R.L.



Each of the tools above was made by immersing the hammer head in a ladle of lead and letting it cool

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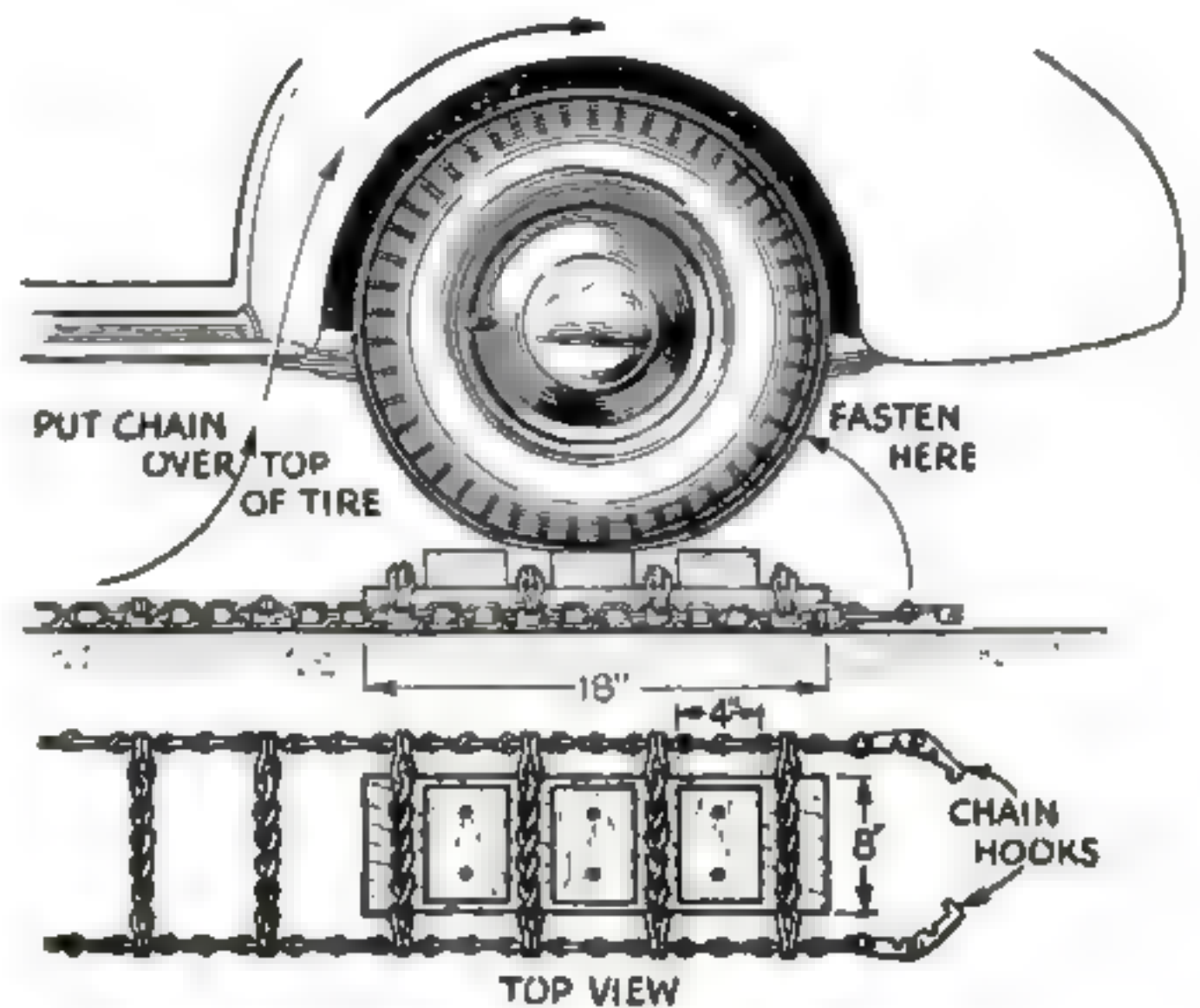
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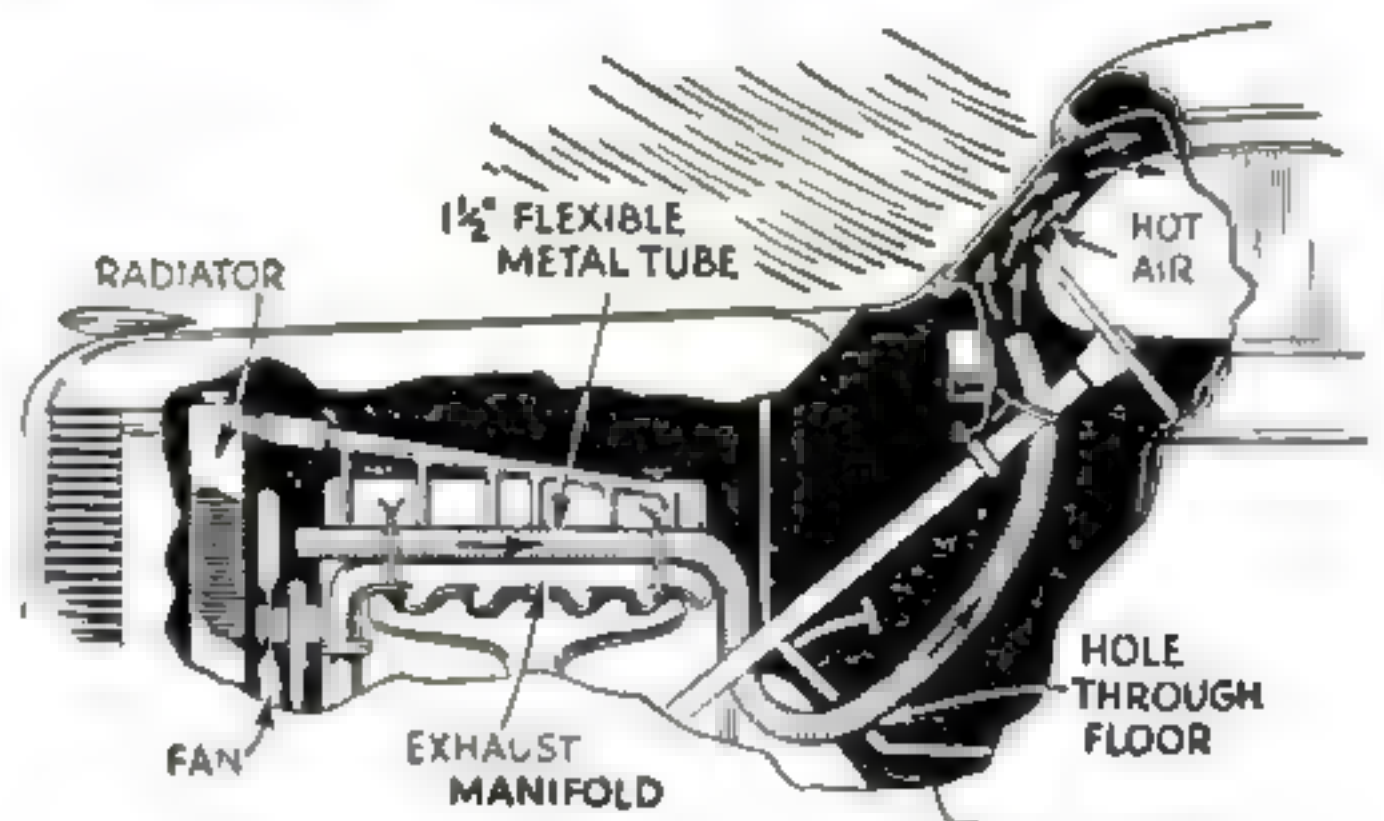
Portable Ramp for Wheel Aids in Fitting Chains



TIRE chains can be put on car wheels quickly and easily by using the simple portable wheel ramp shown above. Three blocks, each measuring two inches by four, are screwed to a plank eight inches wide, and spaced so that the chain cross links fit loosely between them. With the chain laid between the blocks, as pictured above, the car is driven onto the board and the chain wrapped around the tire and hooked fast. Allow enough space between the blocks so that the cross links of the chain can be shifted and adjusted for a close fit around the tire casing.—A. C. S.

Flexible Metal Tube Serves As Defroster

AN EFFICIENT windshield defroster can be improvised from flexible spiral tubing, using the exhaust manifold as a heat source. Wire a length of the tube to the manifold with the open end near the radiator fan. Extend the other end through a hole in the floorboard and fasten it with a length of wire or adhesive tape to the steering column, as pictured in the drawing below.—S. M. C.





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smoking
tobacco*

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of fine old
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aged in wood
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good taste

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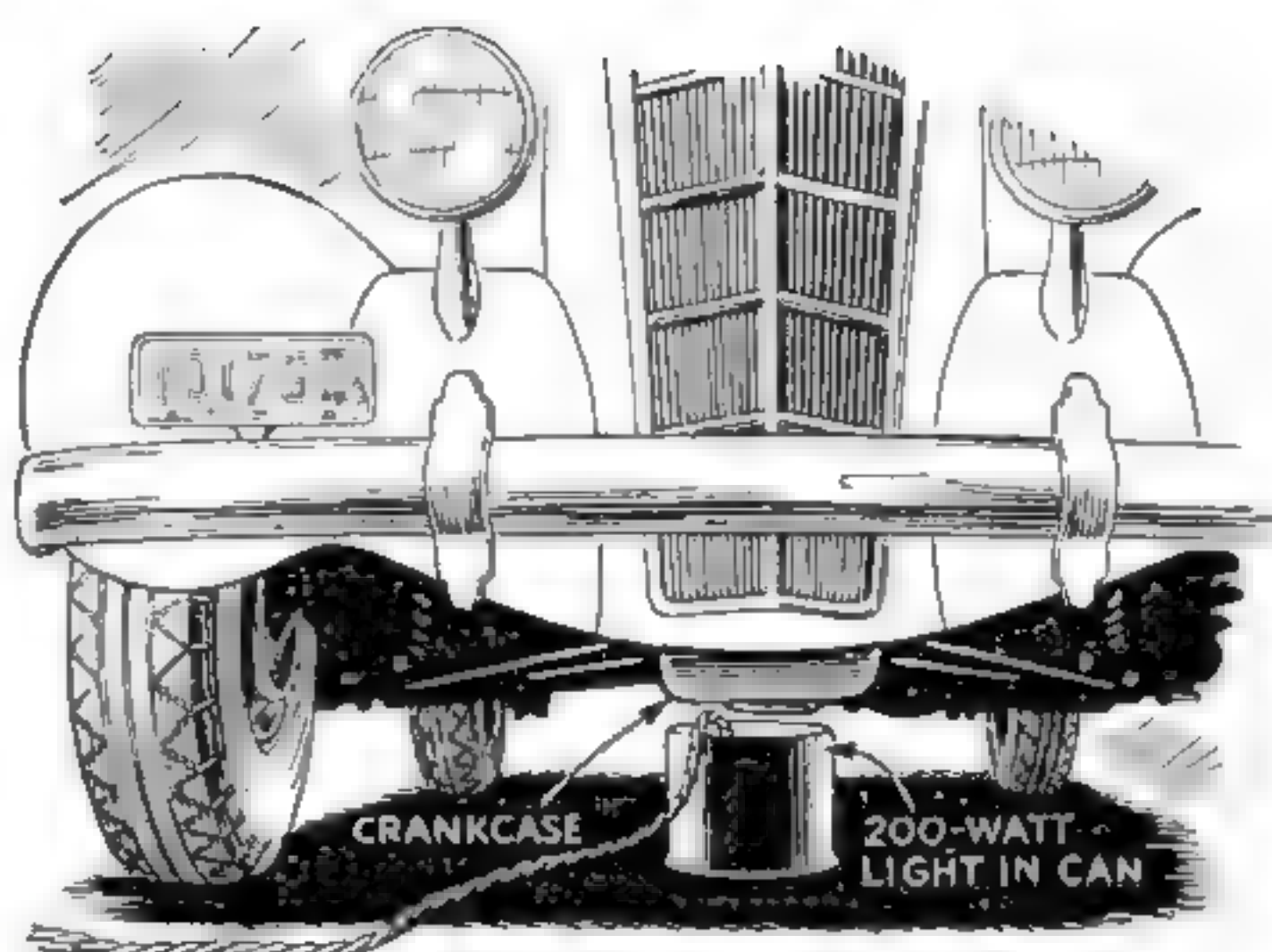
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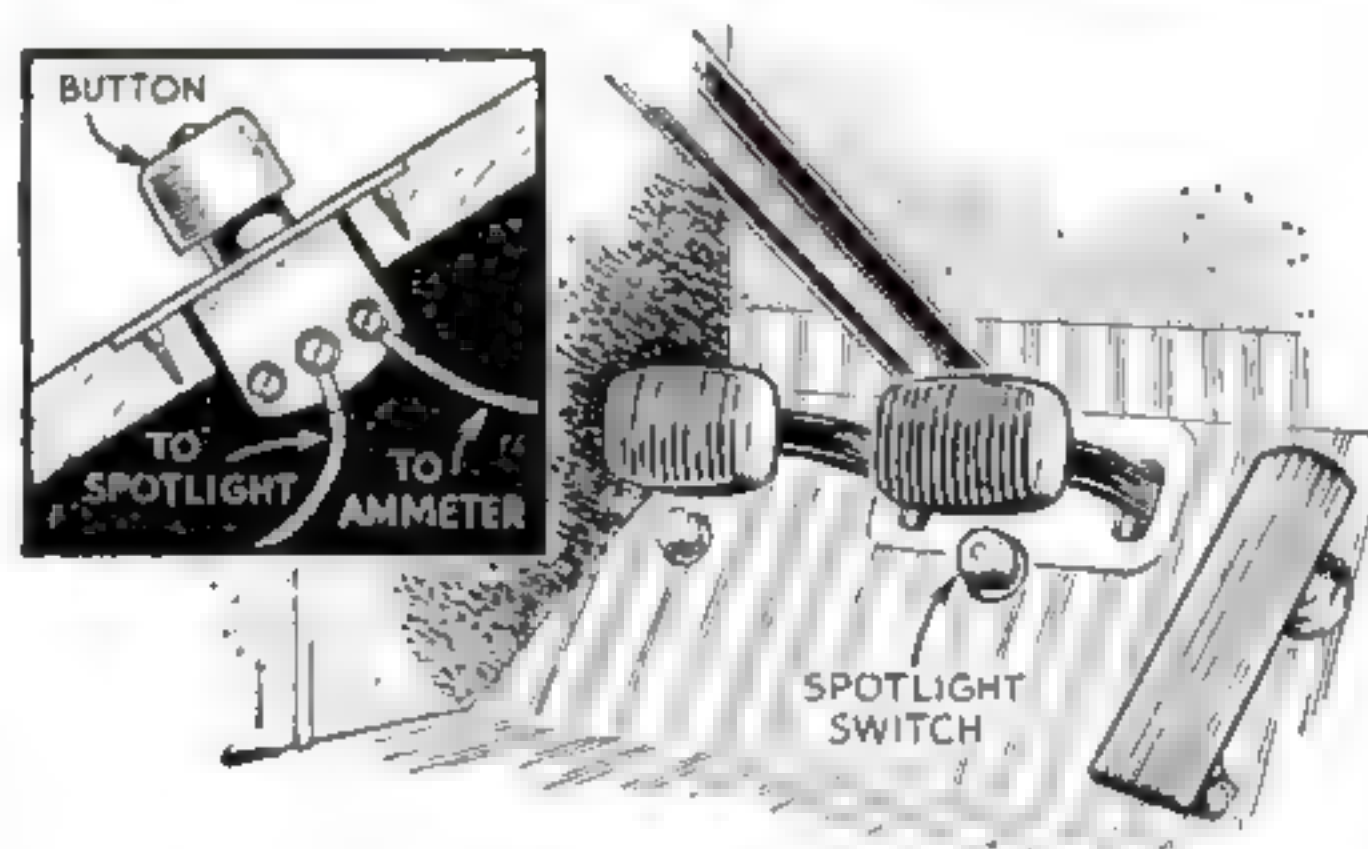
State.....



Heat from Electric Bulb Warms Engine Crankcase

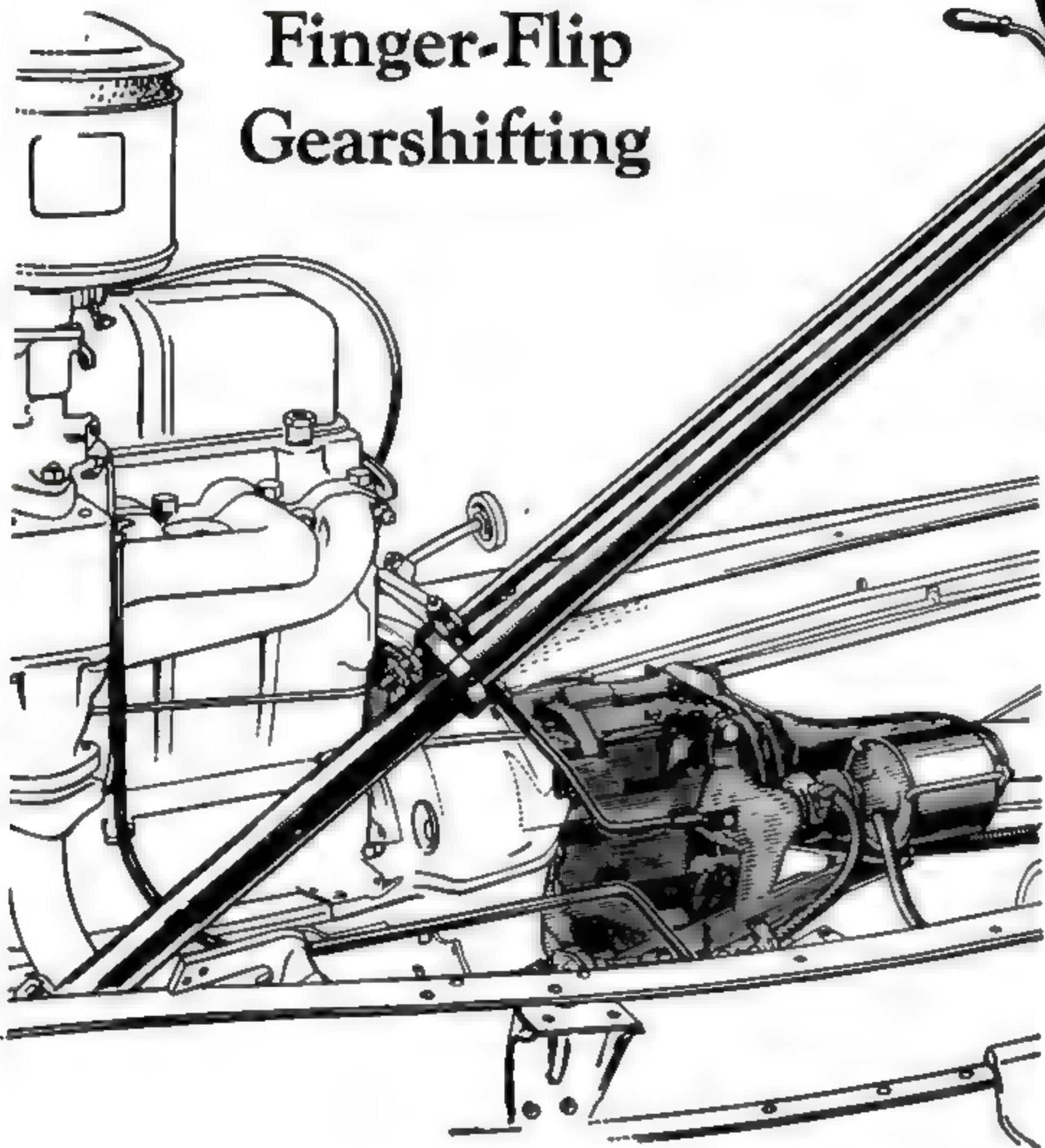
EVEN though a motorist keeps his car in an unheated garage, it will start easily on cold mornings if the oil in the crankcase is kept warm by the following method: Cut off the top of an empty five-quart oil can, and place in it a 100 or 200-watt electric bulb supplied with current by an extension cord. Shove the can under the crankcase at night and switch on the bulb. Heat from the lighted lamp will keep the crankcase oil warm, permitting the engine to turn over rapidly when the starter button is depressed, and insuring quick and easy starting for the motorist in the morning.—L.S.

Spotlight Is Controlled by Extra Switch on Floor



A HEADLIGHT dimmer switch is a convenience for turning a car spotlight on or off. When driving at night, the spotlight switch, placed on the floor between the clutch and brake, makes it unnecessary for the motorist to take his hand off the wheel to cut out the spotlight as another car approaches. How the auxiliary switch is installed is pictured in the drawings above.—R. E. S.

Vacuum Booster Creates Finger-Flip Gearshifting



Gears are shifted by a piston within the vacuum cylinder, mounted at the rear of the transmission. The short shifting-lever at the steering wheel controls the travel of the piston. Shafts and rigid links, instead of flexible cables, transmit movements of the shift lever to the vacuum control valve.



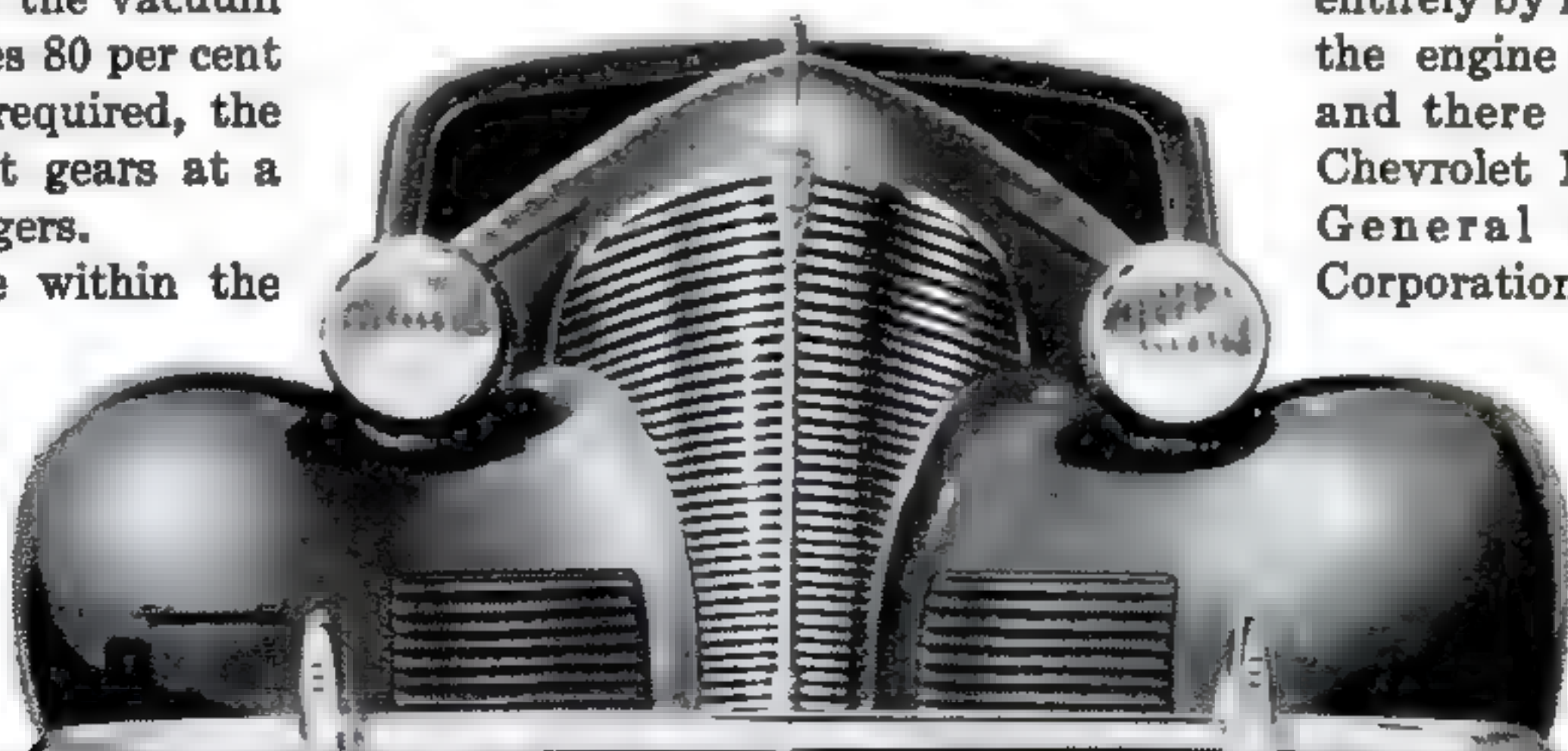
A steering-column gearshift that uses the power of a vacuum cylinder to shift the transmission gears is one of the outstanding motor car improvements for 1939 introduced by Chevrolet, and available on all models at slight extra cost.

The vacuum shift is controlled by a short lever directly under the steering wheel, within finger reach. Because the vacuum cylinder supplies 80 per cent of the energy required, the driver can shift gears at a touch of his fingers.

A slide-valve within the

vacuum cylinder controls the shifting mechanism. The action is so exact that the driver is always in complete control of the shift; in fact, he can "feel" each stage of a shift, as with the floor-board lever.

The hook-up between the shift lever and the transmission is so solid that gears can be shifted entirely by hand power when the engine is not running and there is no vacuum.—Chevrolet Motor Division, General Motors Sales Corporation, Detroit, Mich.



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Camera View Finder Marked to Aid in Focusing

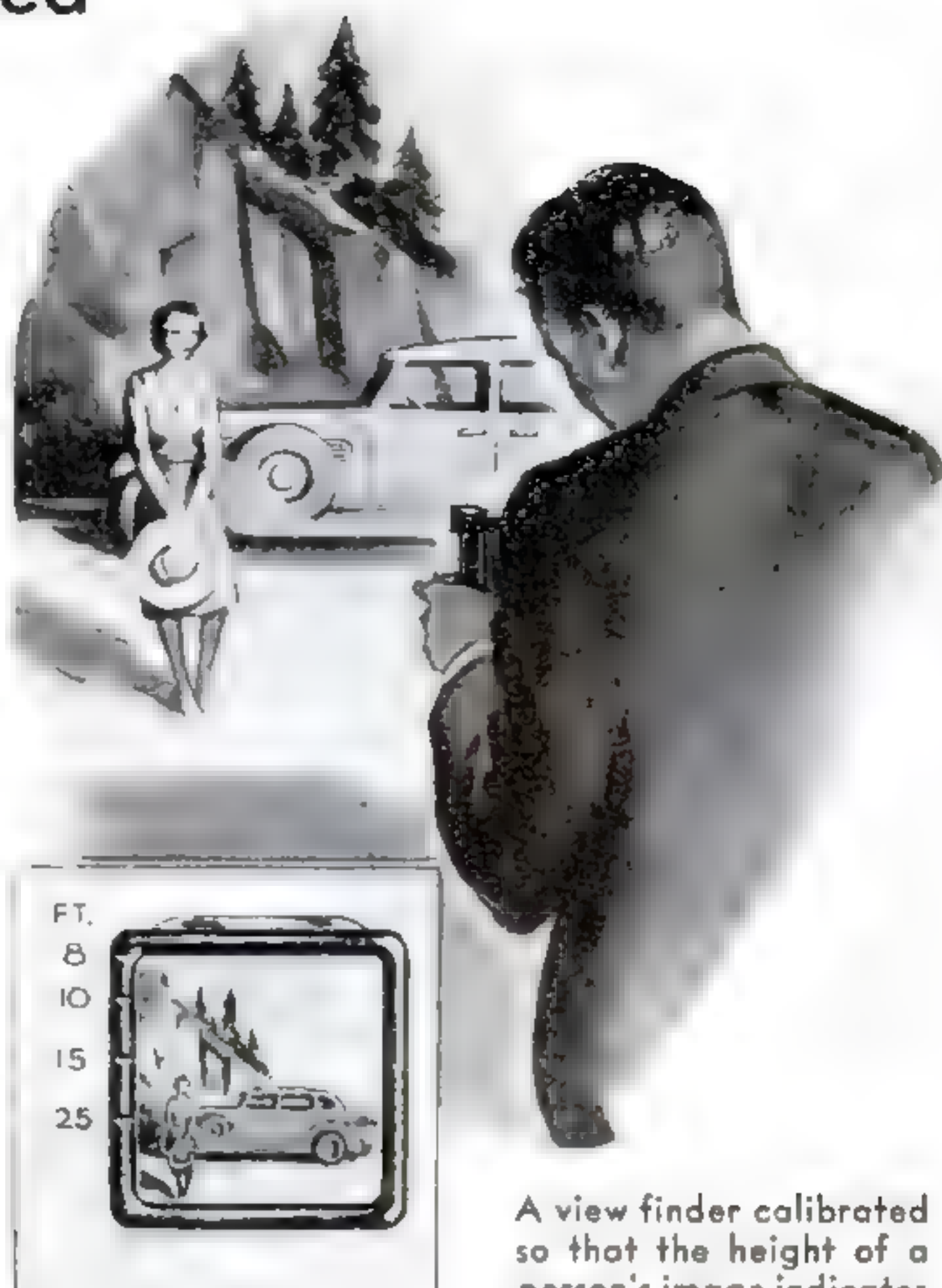
FOR pictures of people, the view finder on your camera can be easily converted into a range finder without interfering with its ordinary use. Have a person of average height, say 5' 9", stand at a measured distance of 8' in front of the camera. Aim the camera so that his image is seen in the view finder with his feet resting on its bottom edge. Then make a mark on the finder even with his head. Repeat this with the person standing at distances of 10', 15', and 25'. As the distance increases, his image size decreases and the markings are made lower each time.

You will now have a set of markings by which you can instantly determine distance by viewing the person to be photographed, with his feet resting on the lower edge of the finder. The marking which his head reaches is the distance at which you should focus the camera.—LOUIS HOCHMAN.



How to Repair Chipped or Leaky Photo Trays

ENAMELED photographic trays are so expensive that it pays to repair them when they become leaky. Clean off the rust by scraping and sanding, and roughen the enamel with emery cloth $\frac{1}{2}$ " each way from the hole. Sandpaper will not do, since it will not scratch the enamel. Rub plastic composition wood into the hole from the inside, allow it to set, and build up a patch outside. When dry, coat again, covering all metal and lapping over the enamel $\frac{3}{8}$ ". After drying, sand smooth and give three coats of some acid-alkali resistant varnish, such as drain-board varnish. Such repairs, if varnished occasionally, last indefinitely. Treat a chipped spot before rust starts to prevent holes.



A view finder calibrated so that the height of a person's image indicates at what distance to focus

Film Spool Opens Packages

A DISCARDED roll-film spool is a handy opener for boxes of photographic papers and cut films. Use the disk at one end to cut through the heavy paper sealing the edges.—W.S.

Easily Read Photo Clock

A CLOCK or watch used in the darkroom can be read more easily if a magnifying lens is placed in front of it. The lens does not have to be large. An inexpensive reading glass will serve, and it may be mounted by removing the handle and setting the threaded portion of the frame in a small hole drilled in a block of wood.—G.S.G.



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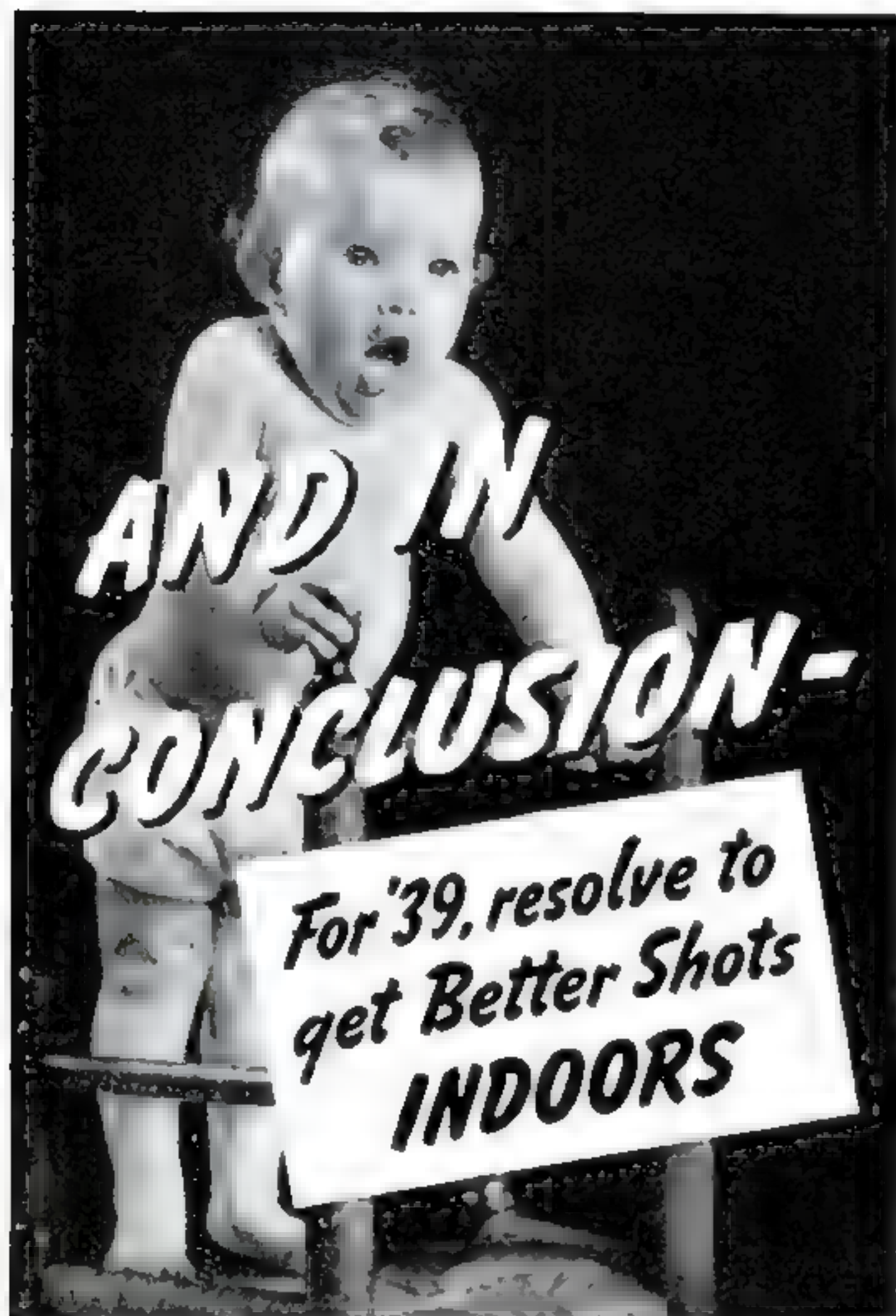
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Two Small Rolls of Film Developed at One Time

MINIATURE camera fans who have many rolls of film to develop may save time by developing two rolls at once by using a tank with an apron. Simply hold the two spools of film as shown and wind both rolls onto the reel at once, with their backs together. To get the knack, practice several times in the light with spoiled or dummy film. The developing, fixing, and washing times should be the same as for a single roll; but allowance, of course, should be made for *two* rolls in calculating the depletion of the developer and fixer.—K.M.S.

Cloth Cover Keeps Dust from an Enlarger

TO KEEP dust away from an enlarger is of prime importance, so it is desirable to place a cloth cover over it when not in use. Tack a large piece of wrapping paper on the wall, set the enlarger close to it with a 100-watt



bulb directly in front, and trace the resulting outline on the paper. Cut two pieces of strong cloth to this pattern and sew them together, leaving the seam on the inside. A draw string on the bottom will hold the cover tight. Leave a slit where the body is attached to the column.

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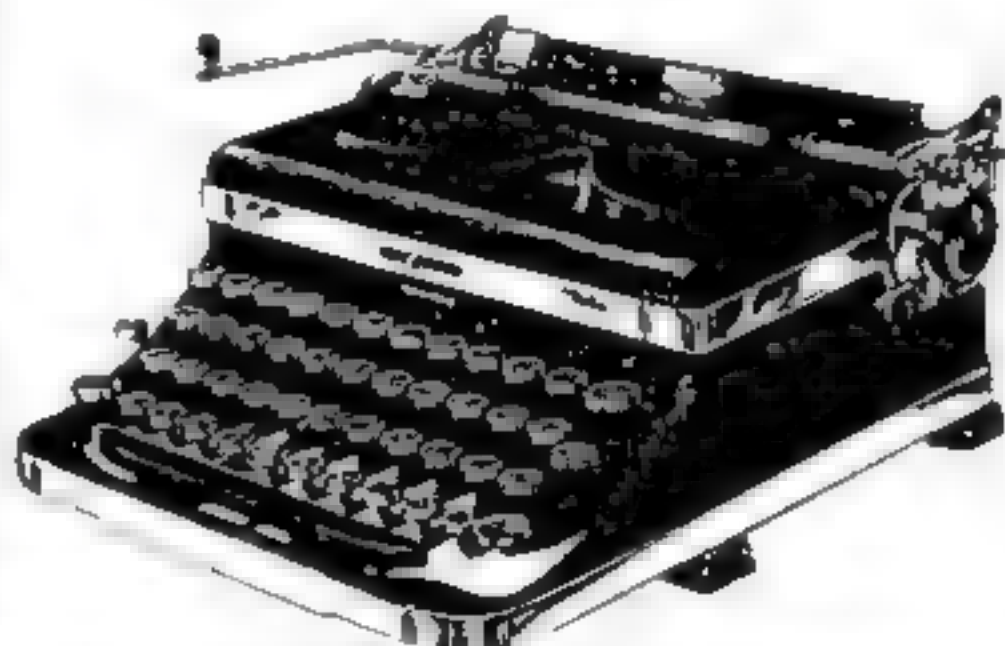
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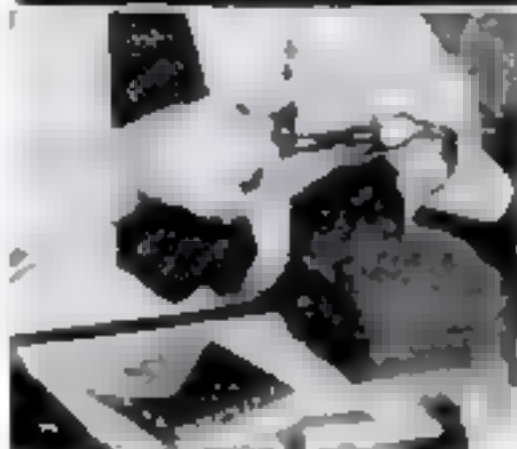
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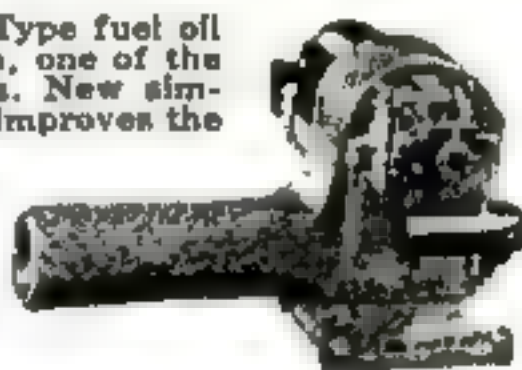
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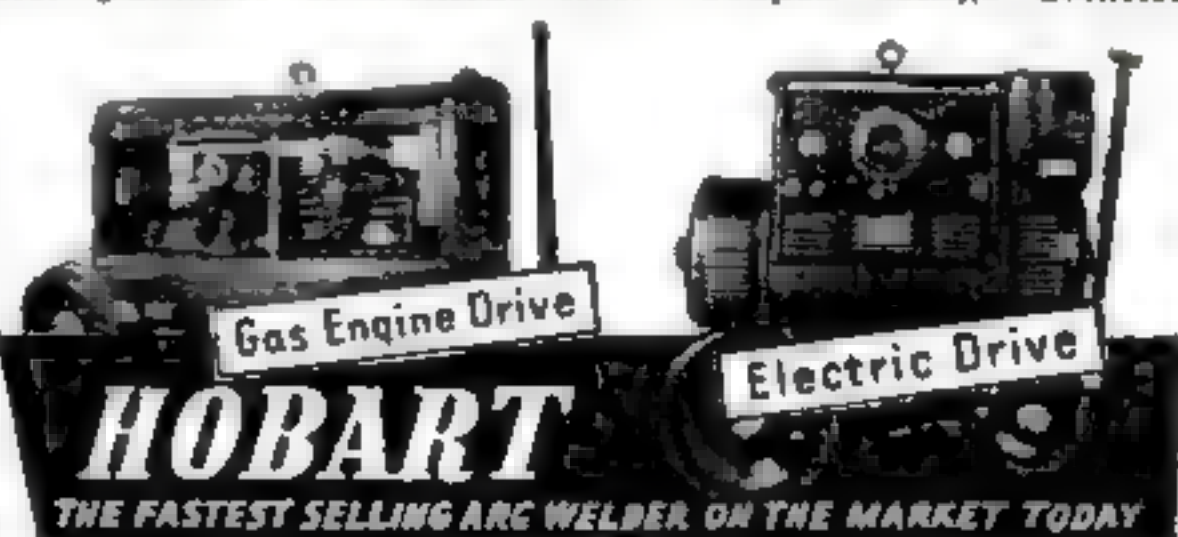
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BLUEPRINTS for Building a Cabin Cruiser

A SEASON of pleasant water trips is before you next summer if you own a boat. Our new 17' cabin cruiser is ideal for voyages up and down rivers and across lakes and bays. By starting construction now, you can have your boat ready before summer arrives. Complete blueprints, drawn to scale, cost only \$1.00.

We can also supply full-size patterns of all the frames (including the two transoms), the main deck beam, and the stem for \$2.50. Patterns for cabin beams are not included because these vary slightly in individual cases, depending upon how the boat is set up. If you wish both blueprints and patterns, the total cost is \$3.50. Since patterns are specially drawn to order, it is necessary to allow a week or two for preparing and mailing them.

A complete list of our blueprints will be mailed upon receipt of a stamped, self-addressed envelope. Below is a partial list:

BOATS

Cabin Cruiser, 17' long, for use with outboard or inboard drives, 356-357-358-359.....	\$1.00
Camper's Utility Boat, 11' 2" long, canvas-covered, for outboard motor or rowing, 281-R.....	.50
Canvas-Covered Duck Boat, 13' 6" long, 279-R.....	.50
Fisherman's Outboard Boat, 9' 3" or 11' 6" long, weighs 115 or 160 lb., for motors from 3 to 16 h.p.; can also be rowed, 344-345-R.....	.75
Motorboat-Rowboat, 13' long, decked hull, for use with outboard or inboard drives, 147-R.....	.50
Outboard Racer, 10' 4" long, weighs 114 lb., for class "A" and "B" motors, 211-212-R.....	.75
Racing Sailboat BLACKCAT, 13' 4" long, weighs 250 lb., Marconi rigged, 321-322-323-R.....	1.00
Sailboat, 12' long, weighs 200 lb.; has fast skimming-dish hull, 314-R.....	.50

FURNITURE

Double-Decker Bed, 277A.....	.25
Early American Round-Top Stand, 191A.....	.50
Fireside Bench, Colonial, 187A-188A.....	.50
Flat Top Desk, 2' 2" by 4' 2" top (no turning), 20....	.25

(Continued on page 236)

HOW DO YOU LOOK IN YOUR BATHING SUIT?

**SKINNY?
THOUSANDS GAIN
10 TO 25 POUNDS
THIS QUICK EASY WAY**



Read how thin, tired-out, nervous, rundown people have gained health and strength—quick!

ARE you ashamed to be seen in a bathing suit, because you're too skinny and scrawny-looking? Are you often tired, nervous—unable to eat and sleep properly?

Then here's wonderful news! Thousands of skinny, rundown men and women have gained 10 to 25 pounds, new pep, new popularity—with this scientific vitamin-rich formula, Ironized Yeast.

Why it builds up so quick

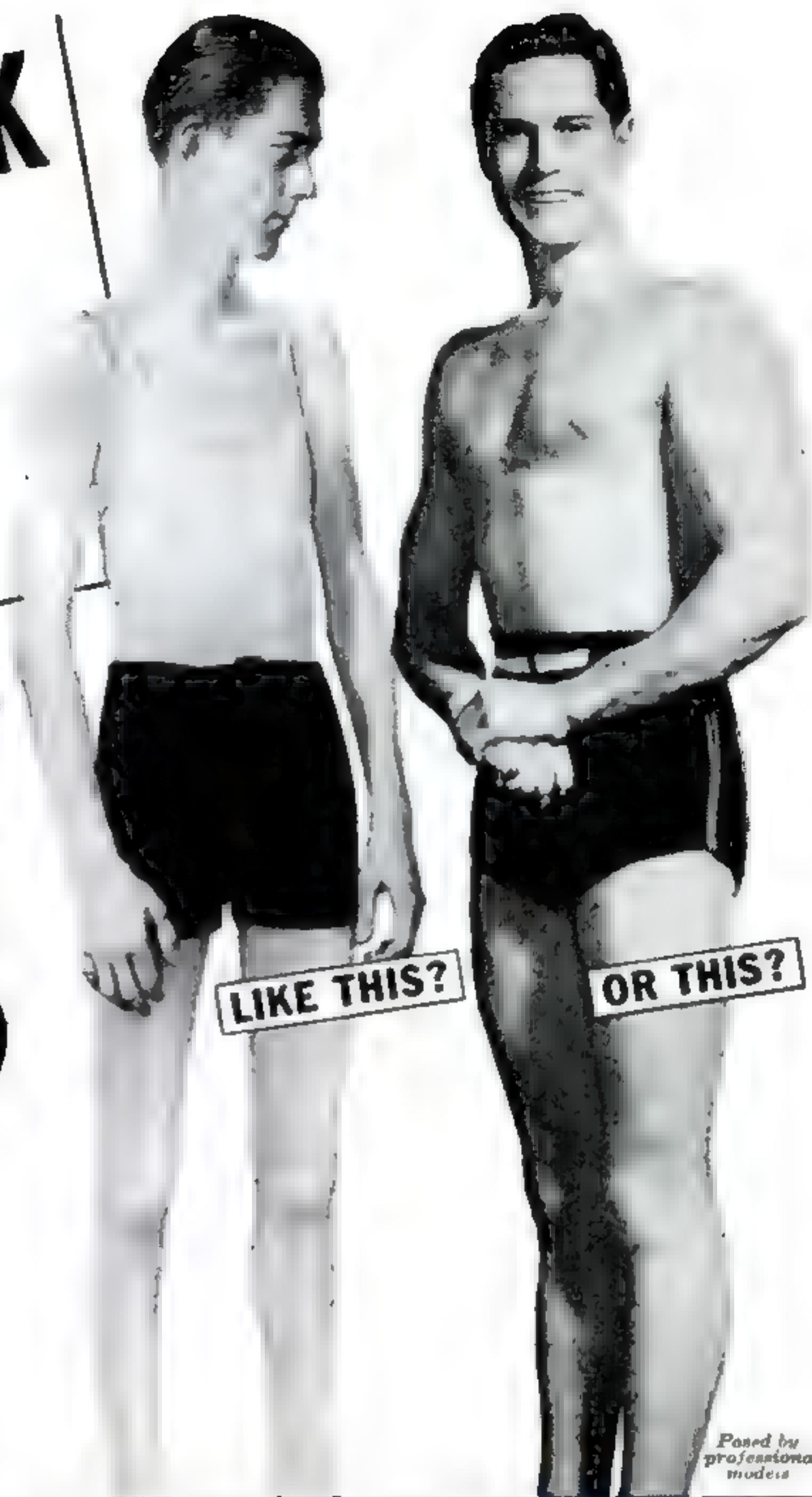
Scientists have discovered that countless people are thin and rundown—tired, cranky, washed-out—only because they don't get enough Vitamin B and iron from their daily food. Without enough of these vital elements you may lack appetite and not get the most body-building good out of what you eat.

Now you get these exact missing elements in these marvelous little Ironized Yeast tablets. No wonder, then, that they have helped thousands of people who needed these elements to gain new naturally attractive pounds, new health and pep, new popularity and success—often in just a few weeks!

Try them without risking a cent

Get Ironized Yeast tablets from your druggist today. If with the first package you don't eat better and **FEEL** better, with much more strength and pep—if you're not convinced that Ironized Yeast will give you the new pounds, new energy and life you've longed for, the price of this first package promptly refunded.

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To start thousands building up their health right away, we make this special offer. Purchase a package of Ironized Yeast tablets at once, cut out the seal on the box and mail it to us with a clipping of this paragraph. We will send you a fascinating new book on health, "New Facts About Your Body." Remember, results with the first package—or money refunded. At all druggists. Ironized Yeast Co., Inc., Dept. 452, Atlanta, Ga.

TUNE IN ON THE GOOD WILL HOUR, every Sunday Evening. See your local paper for time and station.



Irvin Echard
gained 14 lbs. Now I go out regularly, have good times."
Irvin Echard, Barberton, O.

Gains 14 lbs. in 5 Weeks

"I was so skinny I didn't want to go out. Finally, I tried **IRONIZED YEAST**. In five weeks I



R. Loeffler
of pep. Everybody admires my physique, too." **Ralph Loeffler**
Arlington, Wash.

Gains 12 lbs., admired now

"Was losing weight and pep. Then I got Ironized Yeast. In 6 weeks I gained 12 lbs. and am full



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Amazing values in circular saws for your home workshop—KEYSTONE made by DISSTON! True running, long-lived. They fit your machine, suit your work. Designed for fine craftsmanship at low cost. Ask your dealer for Keystone Home Workshop Circular Saws—Made by Disston.

Cross-cut; Combination

6" ($\frac{1}{2}$ " hole) . . .	\$1.70
7" ($\frac{1}{2}$ " hole) . . .	1.80
8" ($\frac{1}{2}$ ", $\frac{3}{8}$ ", $\frac{3}{4}$ " hole)	2.00
10" ($\frac{3}{8}$ ", $\frac{3}{4}$ " hole)	2.40
<i>(Rip saws slightly lower)</i>	
Also Hollow Ground,	
	\$3.00 to \$5.00

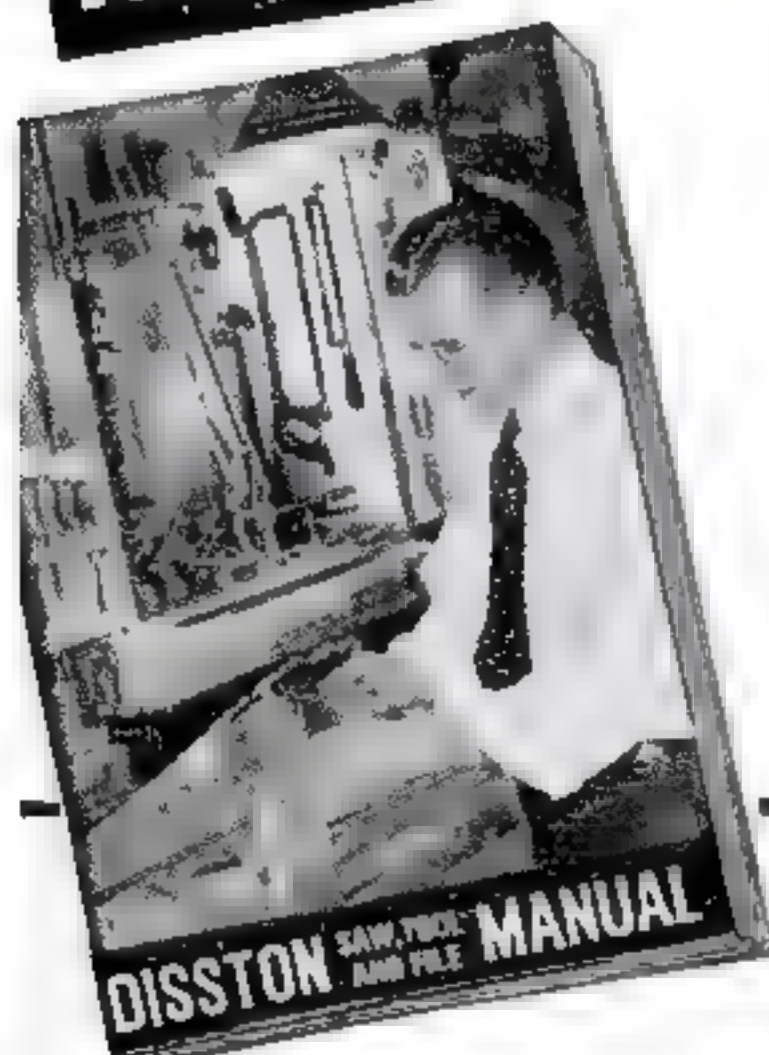
These prices apply only to United States; for others, write Henry Disston & Sons, Ltd., Toronto, Canada

and the Hint of the Month

Trimming inlay picture with "square board" made of $\frac{5}{32}$ " plywood, with a strip to fit table slot clinch-tacked to bottom, and with cross pieces squared to saw.



New edition—FREE BOOK



SEND COUPON!

Completely revised Disston Saw, Tool and File Manual. 48 pages, contains a number of hints like the one above. Tells how to choose saws; to joint, set and sharpen saws; and uses of other kinds of tools. Many illustrations.

Henry Disston & Sons, Inc.
210 Tacony, Philadelphia

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Address.....

Tested Workshop Plans

(Continued from page 234)

Floor Lamp, with tripod base, 243A.....	.25
Four-Leaf Card or Occasional Table, 239A.....	.25
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Magazine Rack, ladder-back style, 250A.....	.25
Modernistic Folding Screens, four designs (no turning), 9125
Sewing Table, 16" by 20" top with drop leaves (no turning), 125
Silverware Chest on Stand, 256A.....	.25
Smoking Stand, modern, 238A.....	.25
Tea Wagon, with removable tray and drop leaves, 20" by 30" top (turning), 13.....	.25
Upholstered Stool, 240A.....	.25

MODELS

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Civil War Ships MONITOR, MERRIMAC, and HARTFORD, water-line models 3 $\frac{1}{2}$ ", 5 $\frac{3}{8}$ ", and 5 $\frac{1}{2}$ " long respectively, 258.....	.25
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Clipper Ship SEA WITCH, 9 $\frac{1}{2}$ " hull, 21925
Coast Guard Patrol of 165-ft. Type, 20 $\frac{5}{8}$ " hull, 286-287-R75
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H. M. S. BOUNTY, 8 $\frac{1}{2}$ " hull, 254.....	.25
Liner NORMANDIE, 20 $\frac{3}{8}$ " hull, 264-265.....	.50
Liner QUEEN MARY, 10 $\frac{1}{4}$ " hull, 28325
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NOURMAHAL, power yacht, 8 $\frac{1}{2}$ " hull, 276.....	.25
Ocean Freighter, 14" hull, 271.....	.25

(Construction kits are available for some of these models. Turn to page 238.)

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Amateur Short Wave Receiver, 3 tubes, battery or 110-volt A.C. or D.C. operation, 155.....	.25
Full Electric Headphone Receiver (can be made compact for portable use), 130.....	.25
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Popular Science Monthly

353 Fourth Avenue, New York

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(Please print your name and address very clearly.)

FAVORITE HOBBY OF MILLIONAIRES

What is the favorite hobby of wealthy business men?—Golf attracts the largest number. But for intensity of interest, wood working easily ranks first.

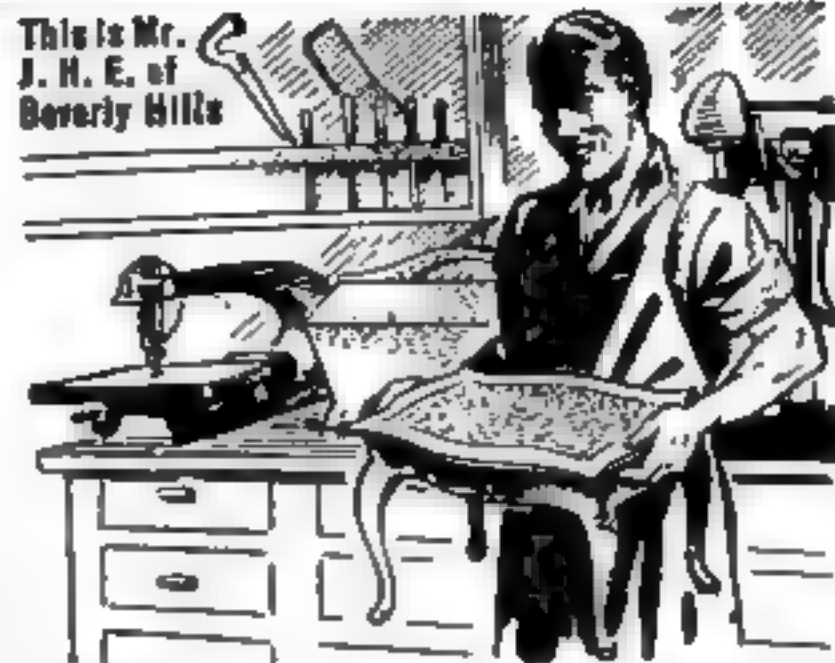
Thousands of business executives, bankers, lawyers and doctors work evening upon evening in the basements of their houses, making tables, chairs and novelties for family and friends. Perhaps few of their neighbors know about this; for, these men will not broadcast their private lives. But ask one of them and see how

proudly he speaks of the products of his creation.

There's a joy in it, a satisfaction, a freedom for tired nerves, that only the experienced wood-worker can understand. The Very First Week a beginner can make something well worth keeping. Then, too, for many men, woodworking is a Money Maker in spare or full time.

So we particularly call attention today to a truly valuable book—Harold Hunt's new 1939 catalog and buyers guide for wood-workers. See coupon at bottom of this page.

This is Mr. J. H. E. of Beverly Hills



THIS man started with a \$1.98 scroll saw outfit. Now the same man has a complete work shop in his basement. He has built up this hobby, improving and perfecting it, until he now earns a tidy sum in his spare time. He makes bookcases, beautiful ball clocks and elegant lamps, all made in his basement, in his spare time!

Read in the new CATALOG No. 11, the interesting letters of wood-workers, wealthy men, poor boys,

old men, young men, those who work for fun and those who work to make money.



Mr. W. G. Watrous, of Libertyville, Ill., a nationally known writer, says:—Here is a piano bench I made 25 years ago. It is the first thing I ever undertook in wood-work. That same piano bench is still used in the home of my daughter. I have found wood-craft the most fascinating of hobbies. It is wonderful for tired nerves.



Mr. James Woodman, Editor and Publisher of the Home Friend, a magazine with a monthly circulation of one million, writes to Mr. Hunt: For many years, my boys and I have all been working together in our little shop during our spare time, making tables, chairs, and other furniture for our own home and for the homes of our relatives and friends.—This work brought us closer together. And now, best of all, my grandsons are showing an aptitude and love for such work.



WHAT a joy to create! What a satisfaction to see the products of one's imagination and handicraft in use, in constant use, by the family and by friends!

Our last previous catalog No. 10 was in such demand that we were unable to supply delayed inquiries.—To make sure of getting this latest 1939 edition catalog No. 11, better write at once!

THE Joy OF WOODCRAFT

Read Harold Hunt's remarkable New 1939 catalog and guide for woodworkers—valuable for experts (and with supplementary "instruction sheets" for beginners).

Needed by Experts:

Page upon page of the latest up-to-date information; new patterns, novel designs, new devices.

Six new pages on wood finishing, the knacks, the little secrets, also, care of the brush, uses of glues, etc.

Extra facile method of inlaying; even a beginner can do it.

235 brand new scroll saw patterns; choice new designs for trimmings; also new types of hardware.

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Complete, detailed directions—so that the merest beginner can start right in with nothing but a hammer, saw and plane (or with a scroll saw) making beautiful, lasting furniture the first week. You should see how absolutely clear everything is made for you in this catalog:

1. Just what tools you need, beginning with only the three or four everyday tools probably now in your basement (or beginning with a scroll saw).

2. Just what lumber to buy and in what sizes and exactly what hardware and miscellany for the things you decide to make.

3. Then precise, detailed directions for the work you select.

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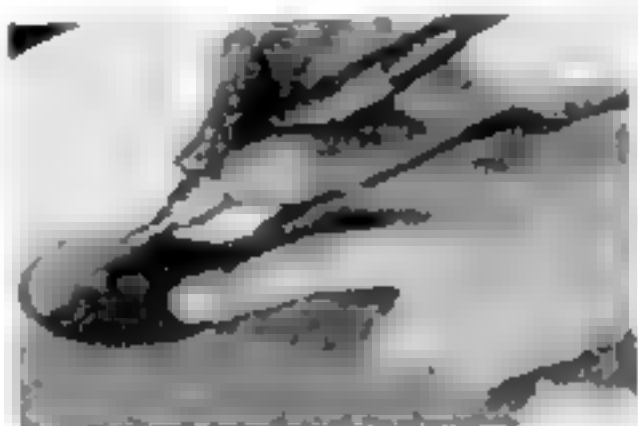


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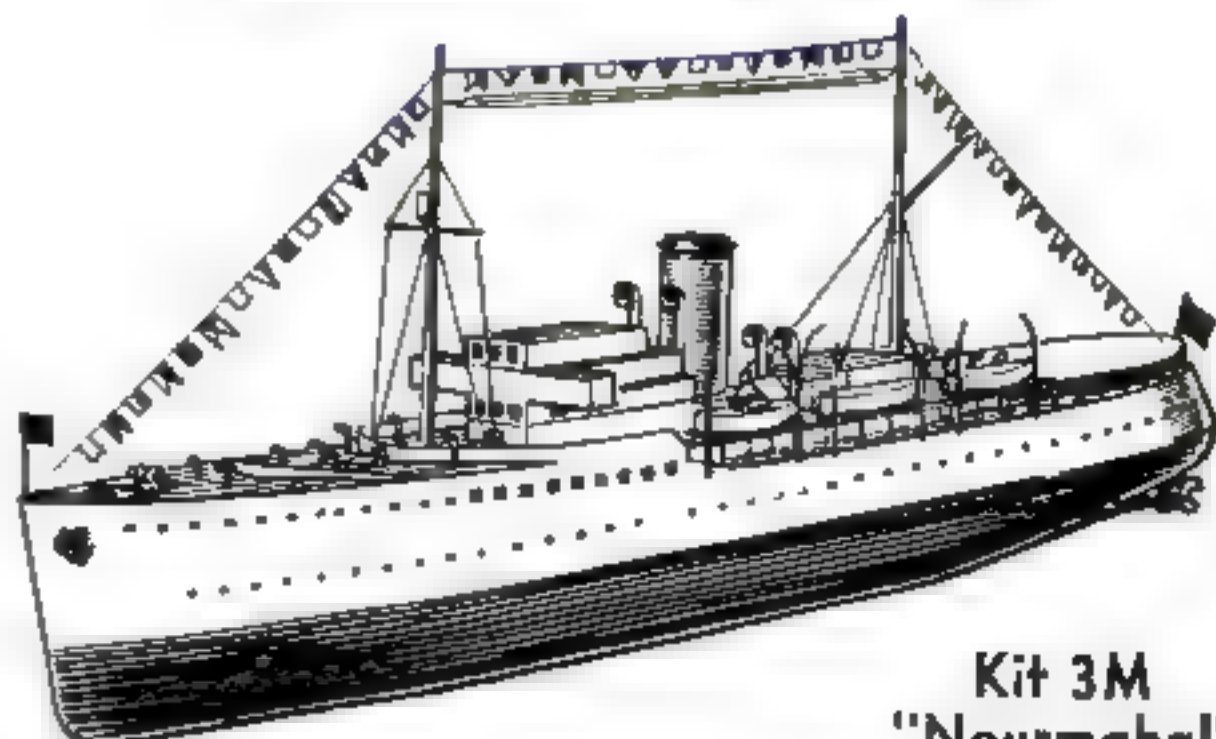
The stately clipper ship at the top of the page is the *Great Republic*. The model measures 42" over all and can be built with Kit 4S (\$8.40*). At the left is the Elizabethan galleon *Revenge* made with Kit G (\$7.25*). It is 28" long. A Spanish galleon (not shown) of the same decorative type can be made with Kit D (\$6.95*).



Kit G—a galleon

For persons desiring more modern craft, there are such models as the yacht *Nourmahal* and the battleship U.S.S. *Texas*. The first can be constructed with Kit 3M (\$1.00) and

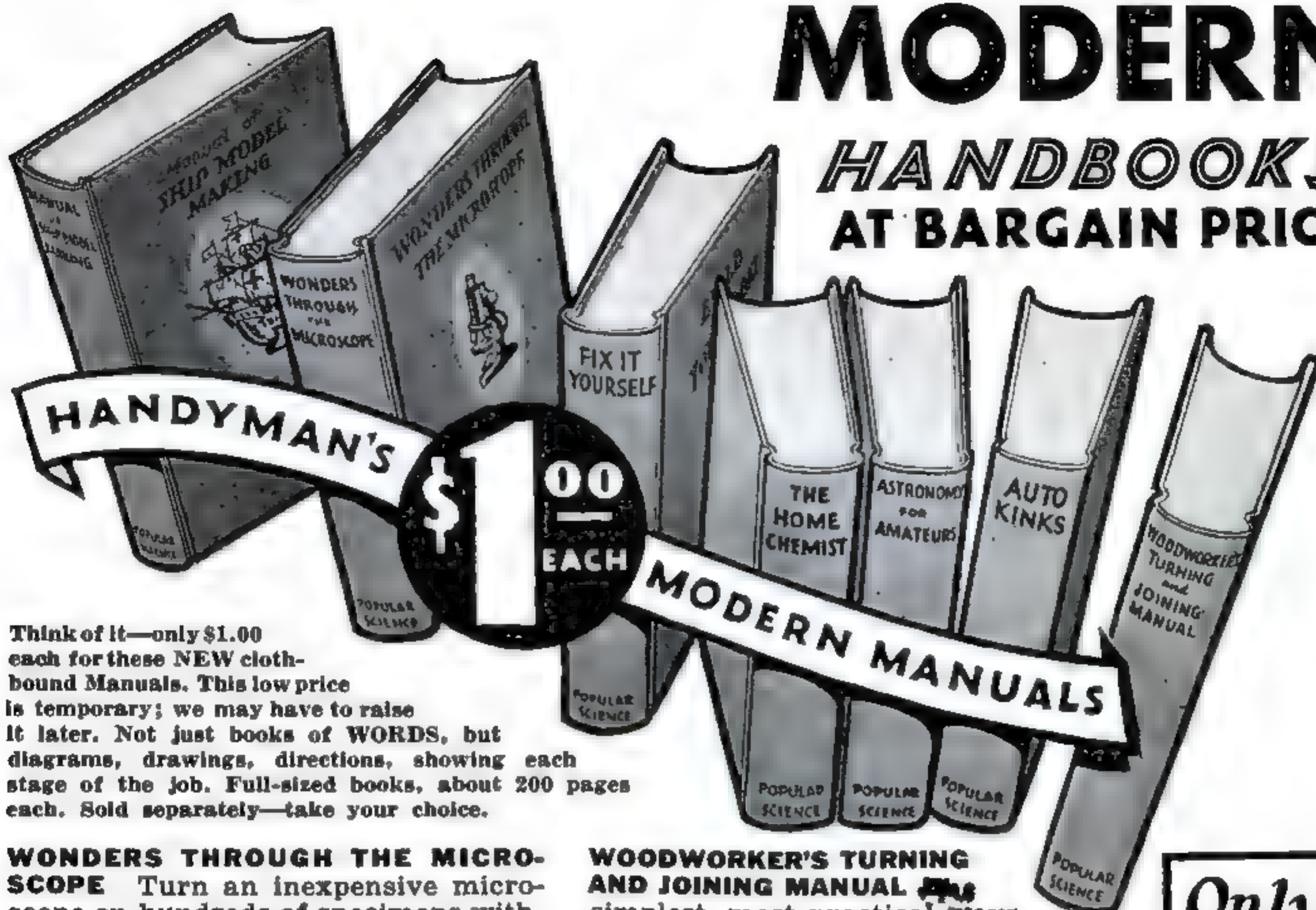
(Continued on page 240)



Kit 3M
"Nourmahal"

MODERN

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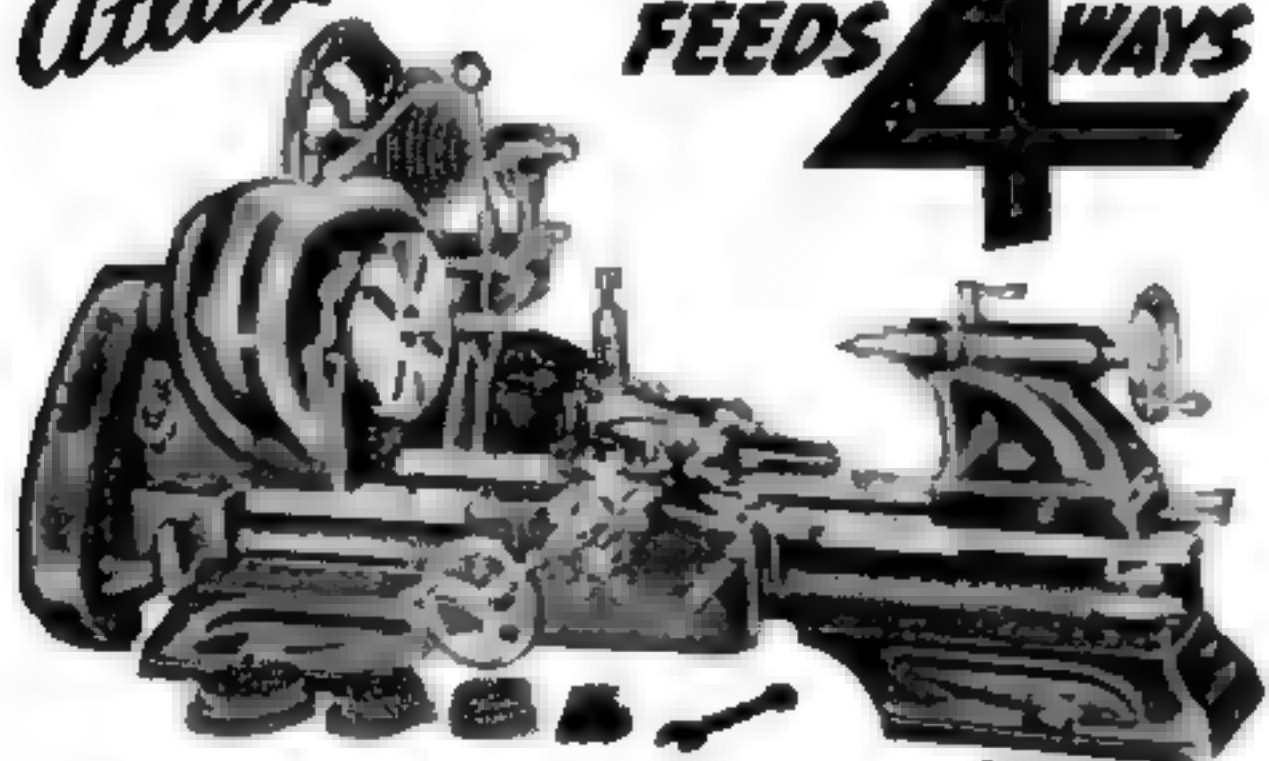
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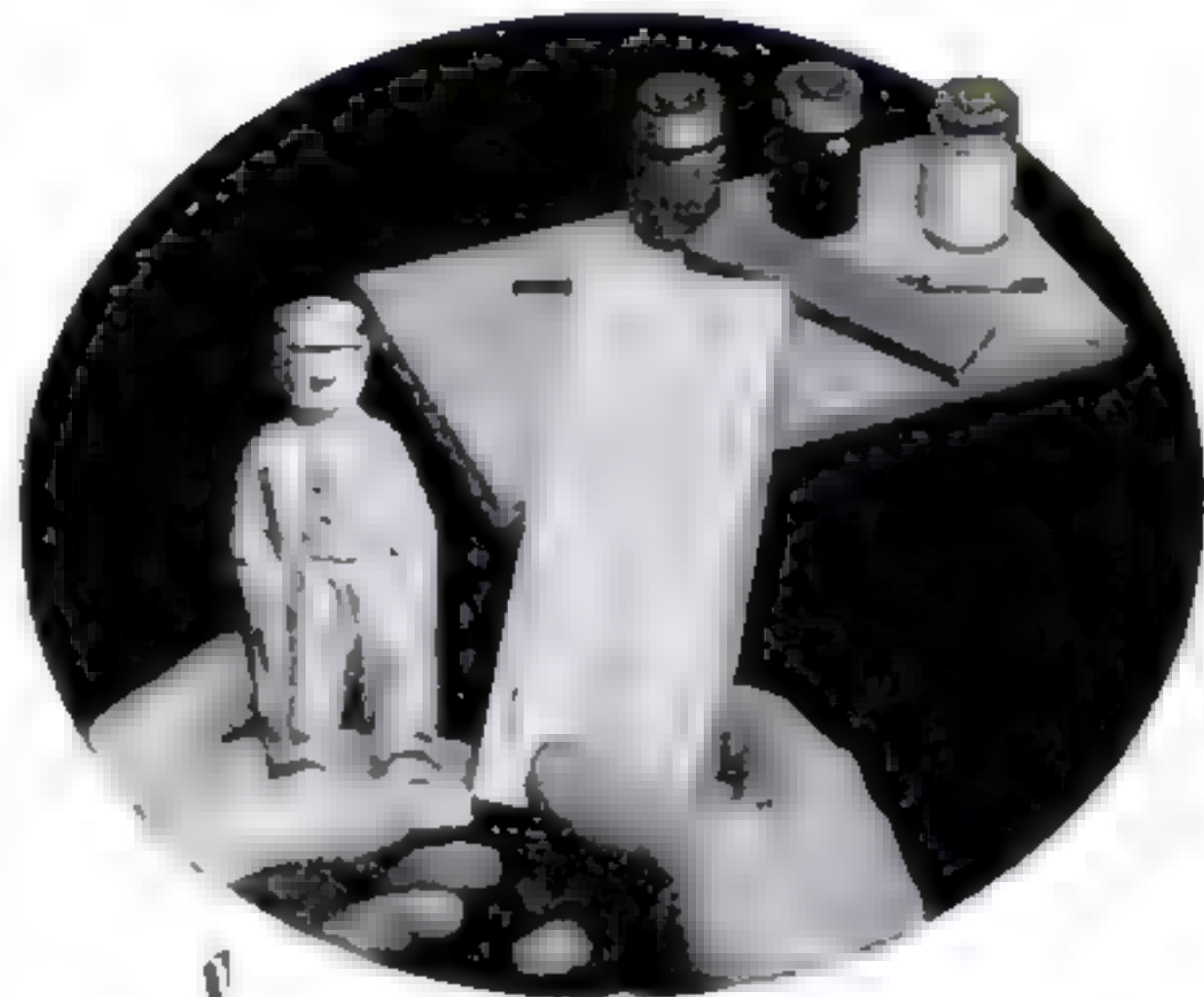
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City and State.....

Kits for Making Models (Continued from page 238)



A master model is contained in Kit 10. At left is the battleship "Texas" built with Kit E



the war vessel with Kit E (\$7.45*). Many other types of models are also available. A complete list of our kits appeared on pages 224 and 226 of the January issue. An illustrated ship-model list will be sent upon receipt of a large, self-

addressed, and stamped envelope.

There are also three kits for whittlers: Kit 7 (\$1.50), a sea captain; Kit 8 (\$1.00), six different Scotties; and Kit 10 (\$1.50), *Hobo Hank*. The latter kit, which is shown above, contains a composition model so that all you have to do is to copy it. This is particularly helpful for beginners because each knife cut can be accurately reproduced.

For model railroad enthusiasts, there is Kit 1L (\$9.95*) with which a 14" HO-gauge model locomotive and tender can be built.

Note: If you live west of the Mississippi River or in Canada, add 50 cents to all prices marked with an asterisk (*).

Popular Science Monthly, Dept. 29A
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Please send me C. O. D. Kit

I will pay the postman the price shown above plus a few cents postage in full payment. (Canadian orders cannot be sent C. O. D.)

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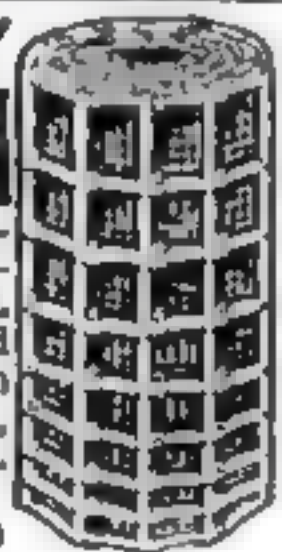
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Colorful Napkin Ring

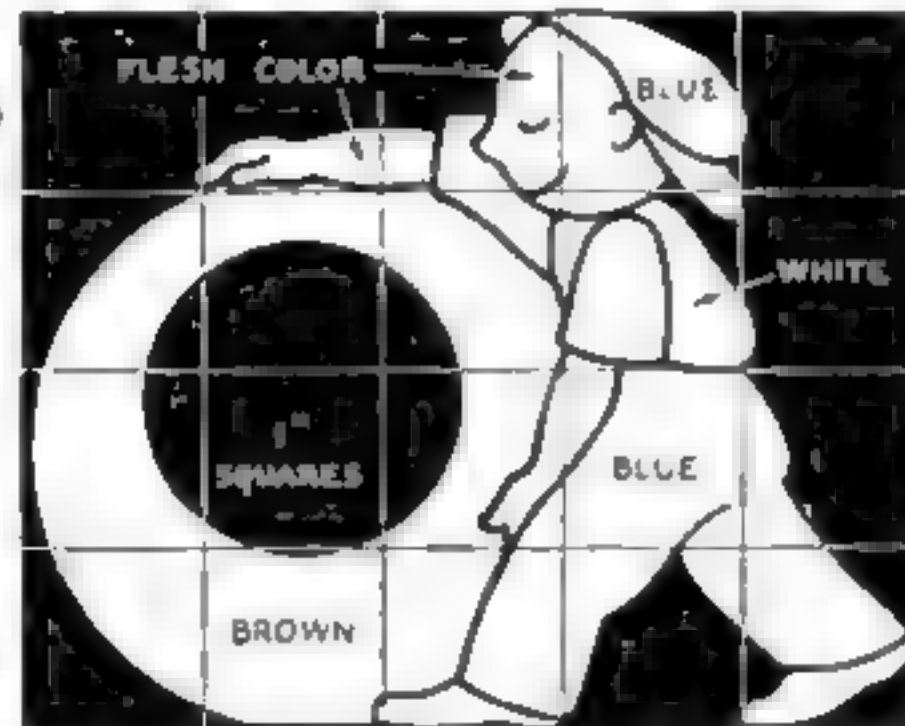
FOR A SMALL CHILD



This attractive holder will encourage any child to put his table napkin away neatly. The ring is cut from wood as at the right

ANY small child will be pleased to roll up his table napkin and put it in this ring, held so cheerfully in readiness by the little figure in long pants. Cut the figure from any scrap of wood. If 1" thick wood is used, the ring will stand up nicely,

but even quite thin material will do. If there are several children, the rings may be varied by painting each in a different bright color scheme. The entire backs should be painted in plain colors to match the ring part.—H.F.S.



Molding Giant Candles for Decorative Purposes

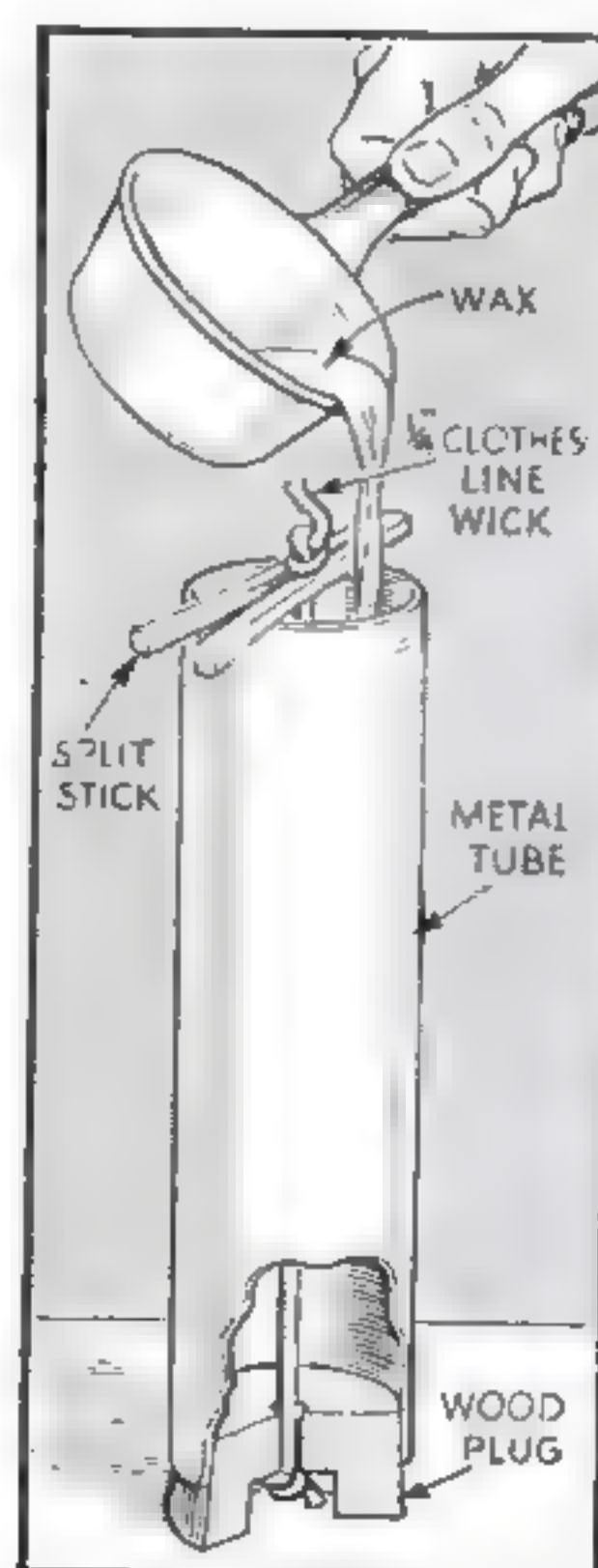
CANDLES from 2" to 4" in diameter, such as interior decorators display so effectively, are easily made. Brass pipe, pneumatic tubing, or even a piece of drain pipe may be used for the mold. The inside must be smoothed with steel wool. A tight-fitting wooden plug is made to fit the bottom, and it should have a hole in the center slightly smaller than the $\frac{1}{4}$ " clothesline used as the wick so the hot wax will not leak through. The hole is countersunk as shown to receive the knot. The other end of the wick is held in place with a split stick.

For a candle 2½" by 12" melt about twenty two-for-five-cent candles of the solid-color type. Heat the metal mold, pour in the wax, and stand the candle, mold and all, in boiling water. Let the candle and water cool together overnight.

When the candle is cool, poke a screw driver down next to the wick. If cooling took place too rapidly, the candle may be hollow, but merely melt a few extra candles to fill the hollow. Let the candle stand until it has become thoroughly hard. Then cut the bottom knot, remove the plug, hold the candle by the wick and dip in hot water to heat the mold and melt the outside of the candle. When the candle has been sufficiently softened on the surface, pull the mold off with one quick jerk. Dip the candle immediately in hot water to smooth out imperfections. When cool, it may be polished with a piece of cloth.

For the decorative drippings, use another

small candle melted in the flame of the large candle. A base may be made by cutting a circular piece of 1" wood with a hole the diameter of the candle. This may be painted silver or enameled a color to contrast with the candle. A piece of plywood or cardboard is glued to the bottom to protect the furniture.—H. E. RUDOLPH.



The finished candle, how it is poured, and the way to represent the drippings



CAR OWNERS!

**New Supercharge
Principle Sets New
Mileage Records**

**JOIN THE PARADE
OF MOTORISTS WHO**

Cut Gas Bills WITH VACU-MATIC

STOP Wasting GAS

**GASOLINE
SAVINGS ^{UP} TO 30%
or it COSTS NOTHING TO TRY**

AUTOMOTIVE ENGINEERS know that cars operate better and use less gasoline when the gas is properly vaporized. Thousands of motorists have learned this secret with better vaporization and substantial gasoline savings with the new VACU-MATIC. Automatically, this amazing discovery instantly puts pep and increased power in any motor. It adds mileage to every gallon of gasoline—produces split-second pick-up, sensitive accelerator response, quicker starting, greater speed, and smoother running. New records are being established everywhere by Vacu-matic users!

Sets New Coast to Chicago Record



Bob McKenzie, transcontinental automobile champion, set a new, all-time Los Angeles to Chicago speed record with a

Vacu-matic equipped Chevrolet. 2322 miles in 39 hrs. and 42 min.—officially

timed average of 59.7 M.P.H.! "Increased my mileage $3\frac{1}{2}$ miles per gallon," he reports.

Automatic -- Nothing Like It!

Vacu-matic is entirely different! It operates on the supercharge principle by automatically adding a charge of extra oxygen, drawn free from the outer air, into the heart of the gas mixture. It is entirely **AUTOMATIC** and allows the motor to "breathe" at the correct time, opening and closing automatically as required. No carburetor adjustments necessary. So simple—so practical it will save you many dollars on gas costs.

Agents and Salesmen—A splendid opportunity for unusual sales and profits. Every car, truck, tractor and motorcycle owner a prospect. Valuable territories now being assigned. Check and mail Free Offer coupon.

The VACU-MATIC Co.

Wauwatosa, Wis.

VACU-MATIC proves itself on every car. It is guaranteed to give worthwhile gas savings, quicker pick-up, and more power or it costs nothing to try. You should instantly tell the difference in added power and motor performance and quickly notice the cash savings on gasoline.

Sworn Statement of Gas Savings

This certifies that I have carefully read 300 original letters received from Vacu-matic users testifying to gas savings up to 30%, many reporting added power, smoother running, and quicker pick-up. These letters are just a small part of the larger file of enthusiastic user letters that I saw at the company offices.



Signed

Morgan J. Plante
Notary Public

Fits All Cars - Easy to Install

Vacu-matic is constructed of six parts, assembled and fused into one unit, correctly adjusted and sealed at the factory. Nothing to regulate. Any motorist can attach VACU-MATIC in ten minutes. Once in, it's only reminder is the surge of instant power and speed it gives to the motor and the savings it affords your pocketbook.

Complete Details Free

You owe it to yourself to know all about this remarkable discovery. Mail the coupon below. Start saving gas with VACU-MATIC and enjoy a new driving thrill! There's no obligation—so get the facts now!

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Gentlemen: Please send me full particulars concerning the VACU-MATIC and details of how I may obtain one for my own car free by helping introduce it to a friend. This does not obligate me in any way.

Name

Address

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We use it too, the same as you
And almost every day

To settle upset
stomachs, or
To chase head-
aches away.

I never mind the winter days
When I am feelin' prime
But, with a cold
or stumick ache
I jest aint worth a dime.
We always like to have a box
Of Alka-Seltzer 'round
I wonder if you'd mind to bring
A package out from town.

An Alka-Seltzer
Tablet in a glass of water makes a spar-
kling pleasant-tasting solution. Drink it
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aches, Sour Stomach, Distress after
meals and other common ailments. It also
helps overcome excess acid condition
so often associated with these troubles.

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Complete set of two foils (swords) and free instruction booklet, only \$1.98. We pay postage.

GREEN NOW.
All-American Fencers Guild, Dept. 2-SP, 48 W. 48th St., New York

Herding Kilowatts

(Continued from page 84)

that keep us high-line patrolmen busy throughout the year. A dirty insulator is a weak insulator, and accumulated dust must not be allowed to remain. In the orange belt, during the winter, clouds of smoke from thousands of smudge pots sometimes coat the insulators with a quarter-inch layer of soot. At regular intervals, every insulator from Boulder Canyon to Los Angeles must be "laundered" fresh and clean. Midnight finds us beneath a tower, our patrol car's powerful spot lights focused on the cross arm overhead, where a slicker-clad man is waiting. He drops a hand line and pulls up the hose. The tank truck's pump spins, a pressure of 1,100 pounds is built up, and through the eight-inch nozzle a jet of clean water neatly strips the insulators of accumulated dirt.

Once a year, each tower is given a fine-tooth inspection, from base to strain sheets joining cables to insulators. Applying a buzzing vibrator to the cable, I set up mechanical oscillations which quickly reveal any loose vibration dampers. In a big file in the chief dispatcher's office, each tower has a separate card recording all the events of its life. Over a period of years, engineers will learn valuable lessons in design from these "case histories."

Though the Boulder high line is the world's longest, highest, and hottest, with its line voltage of 287,000 volts, or nearly 3,000 times that of your light socket—it is also one of the safest. To cope with the tremendous current generated by the mighty Colorado as its waters thunder through the 115,000-horsepower turbines, engineers designed insulators strong enough to stand up under five to seven times the working voltage. The huge chains of saucerlike porcelain plates, hanging from the towers in strings twelve feet long, are protected by big "arcing horns" which deflect flash-overs so the flaming arc leaps upward and away from the porcelain. A high-voltage flash strikes a trip-hammer blow that would shatter the husky insulators as if they were delicate china. But we have never lost a complete string of insulators. In fact, we have few troubles common on high lines—such as birds entangled in the wires, automobiles crashing into poles, or boys' kites. The giant towers spread the cables so wide with their forty-foot cross arms that almost our only worry is that some day an airplane may fall across the line and bring it down.

Each of us works eight hours a day, on the average, and at the end of fifteen days we have six days off. During the fifteen days' duty, we are always on call if trouble comes.

MEGOW MODEL KITS

have very important special features not possessed by others. For instance—the new ready-carved Leading Edge on the PIPER CUB gas-powered model shown below, Motor-Hum Device on flying models, carved hulls on ships and the completeness and low cost of HO-Gauge Model Railroad equipment.



MEGOW SHIP MODEL KITS have carved hulls on all sizes from \$2.00 up. Many ready-made parts also supplied, capstans, anchors, ladders, etc. Also detailed plans and all materials. HISPANIOLA (shown here), ARABELLA (Capt. Blood), XEBEC (Robinson Crusoe) and others, \$2.00. By mail, 15c postage.

Send 5c postage for 100-page illus. catalog of model kits, ready-made parts and supplies.

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describing \$150 prize contest (1st prize, \$25; 2nd, \$15; 3rd, \$10; 66 other cash and merchandise prizes). Cat. illustr. complete power tool line: Jig Saw, \$1.50; Shaper with oilless bearings, \$3; Drill Press, \$2.50; completely equipped lathes, \$2 and \$4.90; Sander, \$1; etc. Order today or send card for Catalog.

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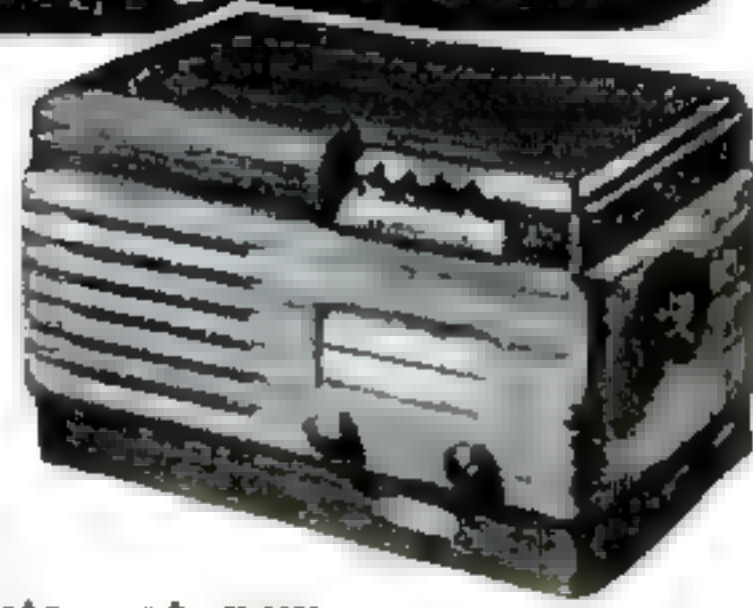
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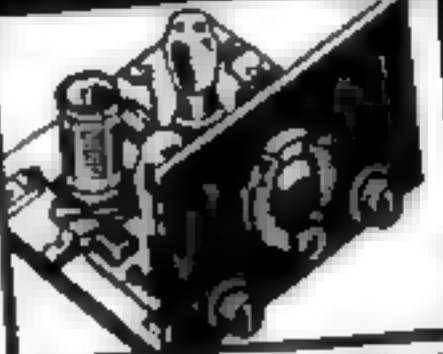
1939 KNIGHT SETS at New Low Prices!



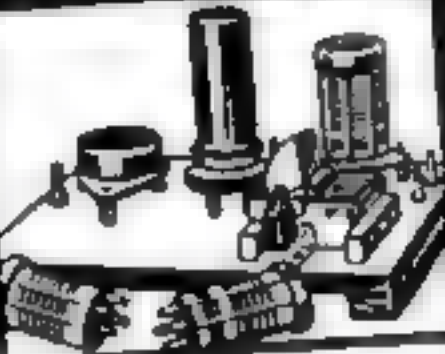
See the amazing new 1939 Knight Radios in your ALLIED Catalog! New features Push-Button Tuning, "Low-Boy" cabinets, 1 1/2 volt tubes, etc.—at new low prices. 62 models, some as low as \$8.95, 4 to 16 tubes, in AC, AC-DC, 1 1/2 Volt, 6 Volt and 32 Volt models. Also new "Tiny Knights", phonographs, phono-radio combinations, record players, etc. They're all in ALLIED's 1939 Catalog—the Buying Guide of Radio Buyers!

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The favorite receiver of thousands! Low in cost, efficient, easy to build. Less coils.....\$3.95



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Advanced type 6L6 Beam-Power Transmitter for C.W. Tunes all bands. Complete, less tube, crystal, and key.....\$3.60



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Ideal for burglar alarms, controlling lights, starting and stopping motors, etc. Complete.....\$5.85



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Chicago, Ill.

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☐ Send me parts list for.....

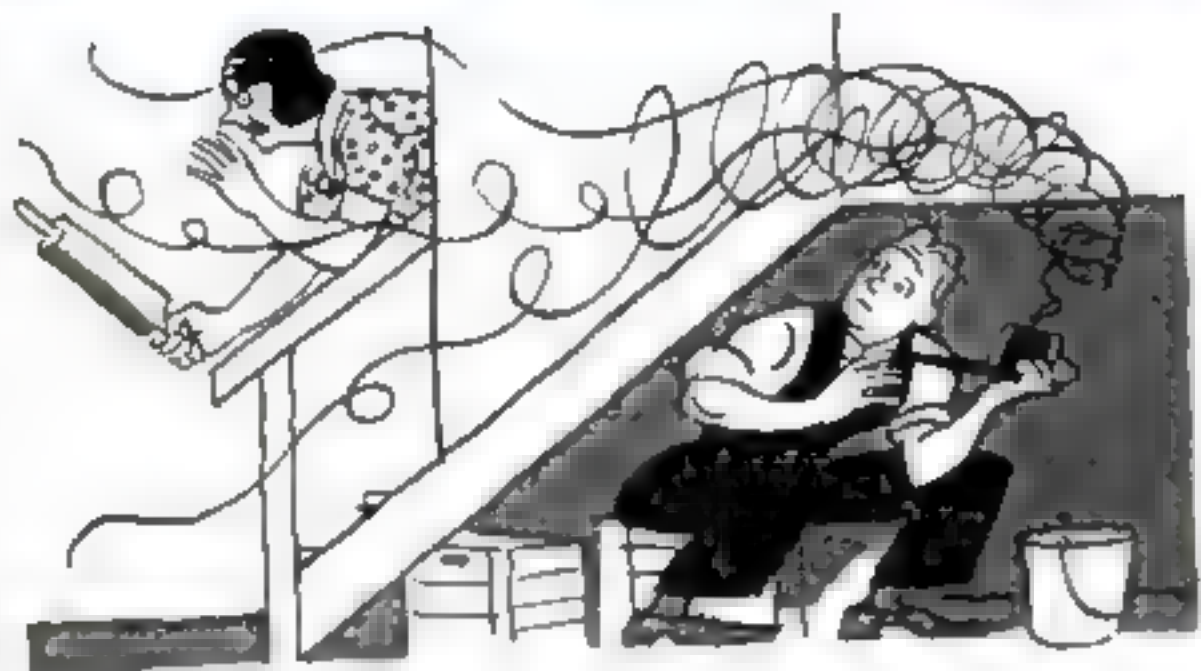
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ALLIED RADIO

HERE'S WHY MARIA WAS MAD AT HIS BRIAR!



HAVE A HEART on your husband, ma'am—don't bawl him out for smoking. After all, it isn't his *pipe* that smells bad, it's that hot-and-heavy *tobacco* he always buys.



NOMORE FIGHTS. Some friend switched him to Sir Walter—two ounces of cool-smokin' burley—so mild it *never* bites the tongue—and a wife-winner for *aroma*!

IT SMOKES
AS SWEET
AS IT SMELLS



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YOUR PIPE

FREE BOOKLET tells how to make your old pipe taste better, sweeter; how to break in a new pipe. Write for your copy today. Brown & Williamson Tobacco Corporation, Louisville, Kentucky, Dept. Y-92.

TUNE IN Tommy Dorsey and his orchestra. Every Wednesday night, coast-to-coast, NBC Red Network.

Gus Plays Detective

(Continued from page 158)

right off the road. And then there are wobbly wheels; they're usually the result of springing the wheel out of line by hitting a curb.

"Well, if the tires and the wheels seem all right, I check the alignment of the wheels—measure the angles of caster, camber, toe-in, and so on. Then I check the inclination of the king-pin, and the tracking of the rear wheels. If that's all O.K., I begin to admit to myself that maybe there's something wrong with the steering gear.

"Sometimes some part of the steering system is adjusted too tightly or not tightly enough. Too much tightness will cause hard steering around turns, and sometimes wandering; too much play nearly always will cause wandering. If the bad adjustment is in the steering gear itself, it usually is easy to locate. If the gear is too loose, you get a wobbly sort of feeling as soon as you give the steering wheel a twist; if it is too tight, you get a stiff, binding feeling.

"In modern steering systems—especially on cars that have independently sprung wheels—the various arms and rods that connect the Pitman arm with the steering knuckles are more likely to need adjustment than are the gears in the steering column. Especially the tie-rod ends—there are four of them, two connecting the tie rods with the steering arm near the center of the car, and the other two connecting the tie rods with the steering-knuckle arms, out near the wheels. When they work loose, they cause shimmying. The tip-off is a rattle, usually out toward the wheels, but sometimes at the connections to the steering arm."

Mrs. Miller had driven her car away, and Harry had gone home, when Gus heard the office telephone ring, and then his partner's voice answering the call. A minute later Joe Clark put his head in at the shop door.

"That was Jerry Corcoran," he reported. "He says that the G-men have found Scarpati—in a hide-out thirty miles over the state line. The fellow Jerry was after confessed. Jerry says that you deserve all the credit—the thug thought that he was clean because they had switched Silvio to the other car, but when he was told how and why his car had stopped shimmying and started weaving, he spilled the beans."

"Swell!" Gus said. "I hope that they promote Jerry to captain, or something."

"So do I," said Joe. "If they raise his pay, the first thing he'll do is buy a car. And if he buys a car, the Model Garage will get his business."

"You're mercenary," Gus said.

PRESTO! MASTER GLAZE

ANYONE CAN

LEAVES HARD GLASS-LIKE FINISH
EASY TO APPLY
PROTECTS THE SURFACE
WILL NOT FINGER-MARK
EASY TO KEEP CLEAN
NO SMEAR OR STREAKS AS WITH WAX
LASTS SIX MONTHS TO A YEAR
SEALS THE PORES OF THE SURFACE
NO OILY FILM AS WITH POLISH
SAVES YOU MONEY

Car Owners! Meet Master Glaze — the sensationally different luster for new and used cars! Not a wax — not an oil polish — not a paint — nothing that "smears" over the surface. MASTER GLAZE is a unique discovery—a creamy liquid—quick and easy to apply! Gives a hard, glass-like surface. Even gasoline cannot dull it! Lasts six months to a year! Amazing luster—beautiful, sparkling clean and brilliant! Doesn't fingermark—doesn't smear! A match box full glazes an entire car. Seals the pores—protects! Nothing like it!

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BEFORE **AFTER**

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All Car Owners ACT NOW while offer is on. Use 1c postcard. [10] Reference: K.C. Banks—Chamber of Commerce

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**188
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Stamps and Coins Under Your Microscope

(Continued from page 215)

alone. This faint mark evidently was made by a tiny crack in the plate from which the stamp was printed.

Or you may be examining a two-cent violet stamp of the Columbian issue of 1893. Look carefully at the third figure to the left of Columbus, in the scene depicting the landing of the explorer. On some of the stamps, this figure has a broken hat, the break being a wedge-shaped, clear spot in the crown (see illustrations). This flaw increases the catalogue value of the stamp from three to five times.

And so on, almost without limit. Imperfections can be discovered and studied in stamps with a simple hand magnifier. But a compound microscope of not too high power will open up a wider field for explorations.

And in a similar way you can study coins. You will be surprised at the things you can see with a microscope on the dime you have in your pocket. Perhaps the first thing that will surprise you is the cargo of debris it carries—dirt that might include anything from cotton fibers, grains of starch, and bits of wood, to bacteria capable of causing some deadly disease.

As for the coin itself, there are numerous things that can be studied at low, moderate, and high magnifications. Even a hasty observation of the engraved letters and figures will reveal surprising differences among similar ones on different coins. Often, with a microscope, a date or other inscription that has been rendered otherwise illegible by wear or damage can be figured out. The marks made by the engraver's tools on the original die can be seen clearly.

For examining stamps, coins and other opaque objects, a light source that can be placed close to the microscope nose is most convenient. The accompanying illustrations will aid you in the construction of such an illuminator. It is operated by two flash-light cells, which provide enough current for several hours of continuous burning, and which make the illuminator useful where electric power lines are lacking.

The light source is a flash-light lamp of the lens type, the kind usually employed for fountain-pen and similar pocket flash lights. The glass is molded like a lens, and acts as a condenser to focus the filament light into a rather narrow beam. The illuminator consists of a wooden base for holding the battery cells, an adjustable mount for the flash-light lamp, and sufficient wire and solder to make the connections as shown.



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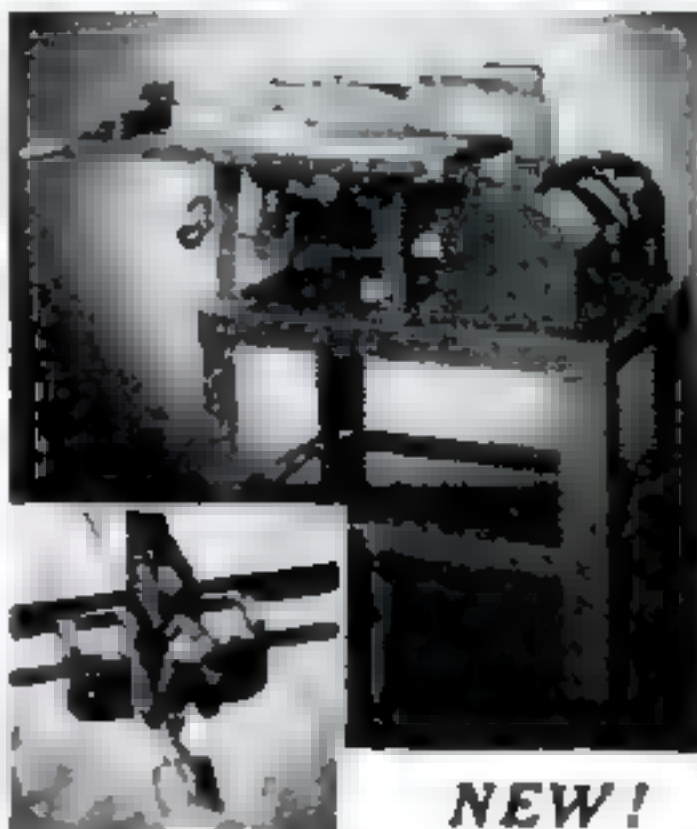
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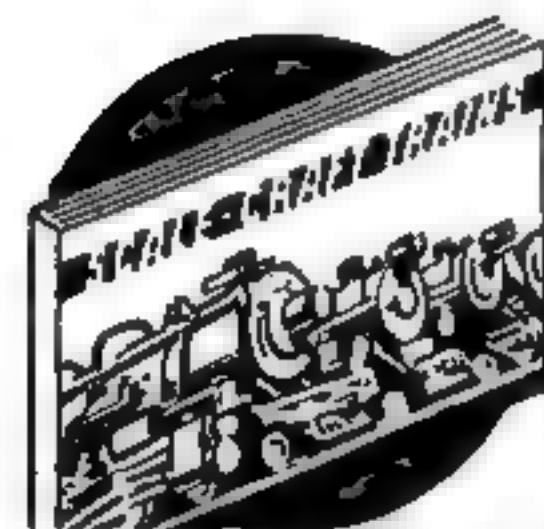
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Home Tests with Dry Ice

(Continued from page 211)

a few cubic centimeters of the colorless liquid
upon a sheet of glass. (This should be done
slowly to protect the face and eyes from a
rush of ammonia vapor that would otherwise
be released.) At room temperature, the glass
is so hot in comparison with the ammonia
that the fluid will boil.

Liquid ammonia makes a good solvent, as
you can verify by adding small pieces of
iodine and sulphur to it.

Pour another sample of liquid ammonia
upon a few granules of anhydrous calcium
chloride. You will observe a vigorous inter-
action. The two substances combine chemi-
cally and form what chemists call an
"addition compound," consisting of one mole-
cule of calcium chloride and eight molecules
of ammonia.

The first test tube in your apparatus will
not condense all of the ammonia gas flowing
through. Some of the vapor will pass into
the second low-temperature tube, containing
the zinc chloride. The ammonia will react
with this chemical and form an addition com-
pound, just as it did with calcium chloride.
The zinc chloride-ammonia reaction, however,
has the peculiarity of increasing the volume
of solid matter quite rapidly. From time to
time you can observe this gain in volume, by
withdrawing the delivery tube from this test
tube and peering cautiously within. Keep the
tube at a safe distance while you do this, to
avoid getting a whiff or an eyeful of the irri-
tating vapor.

In the course of these experiments, you
need not be mystified by the ice that forms
upon the outside of containers of solid carbon
dioxide. Moisture from the air condenses on
the outer walls of the vessels, just as dew
forms on a pitcher of ice water, but the dry
ice is so much colder that the dew is frozen.

POPULAR SCIENCE Question Bee

IN THE list below, letters indicate the cor-
rect answers for the Question Bee on page
152. Check your own results against it. To
find out what score you made, give yourself
five points for each one that you got right.
A total of 75 to 85 points is good; 90 or bet-
ter is excellent.

- | | | | | |
|------|------|-------|-------|-------|
| 1. b | 5. d | 9. b | 13. b | 17. c |
| 2. c | 6. c | 10. c | 14. a | 18. d |
| 3. d | 7. a | 11. a | 15. c | 19. b |
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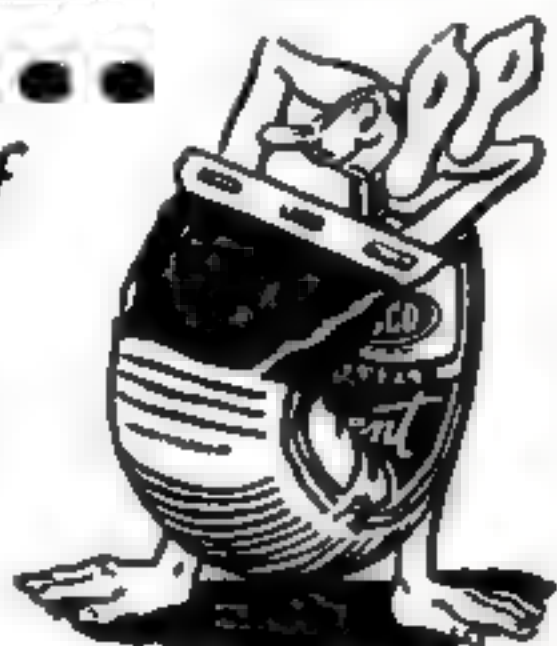
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Beginner's Receiver

(Continued from page 223)

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Mica condenser, .004 mfd.
Mica condenser, .001 mfd.
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Resistor, 3 meg., ½ watt.
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Twin-triode radio tube (4A6G).
Octal socket.
Six-prong socket.
Audio-frequency transformer.
Radio-frequency choke.
Rheostat, 20 ohm.
Two switches.

Miscellaneous:—Chassis, composi-
tion panel, five-way battery cable,
plugs, jacks, wire, screws, etc.

seem to be the most desirable to the builder.

There is one important thing to remem-
ber: When the filaments are in parallel, the
rated "A" supply is 2 volts; but with the
series arrangement, the "A" supply must
be increased to 4½ volts. However, with
the filaments in series, the tube consumes
only half the current required by the fila-
ments in parallel, so that for portable work,
the series filament connection is the most
practical and economical.

A steel chassis measuring 1½" by 5½"
by 7" was used for the receiver.

The front panel is made of a composition
material 3/16" thick. The panel should be
nonmagnetic, strong, and durable, yet easy
to work with ordinary woodworking tools.

A .00032-mfd. variable tuning condenser
was chosen. Its high maximum capacity al-
lows the entire broadcast band to be covered
with a single six-prong plug-in coil. How-
ever, if the reader desires, he may substitute
a standard .00014-mfd. condenser for the
larger condenser used in the original design.

With reference to the wiring diagram, the
following adjustments must be made for the
various power supplies. With the filament
plug in jack "a" a two-cell or 4½-volt stor-
age battery can be used with switch "C"
open. Three dry cells giving the same volt-
age may be substituted if desired. In neither
of these arrangements is the rheostat brought
into use.

If a single two-volt storage battery is
used, the plug must be moved to jack "b" and
the rheostat turned on full. With two dry
cells developing three volts, the plug should
be inserted in jack "b" after the rheostat
has been adjusted to reduce the voltage to
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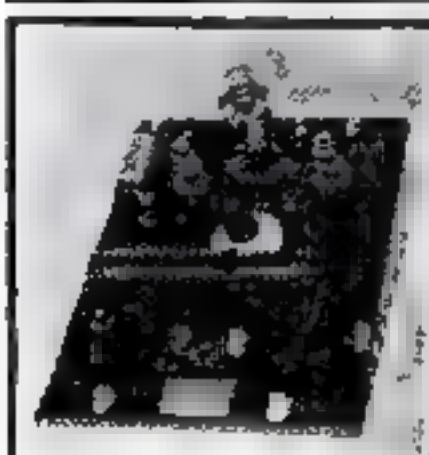
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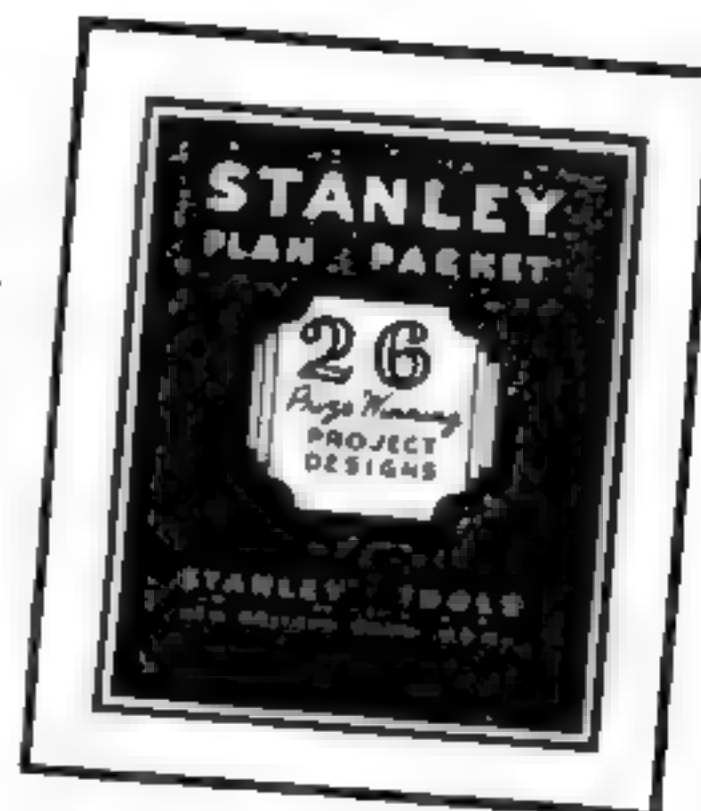
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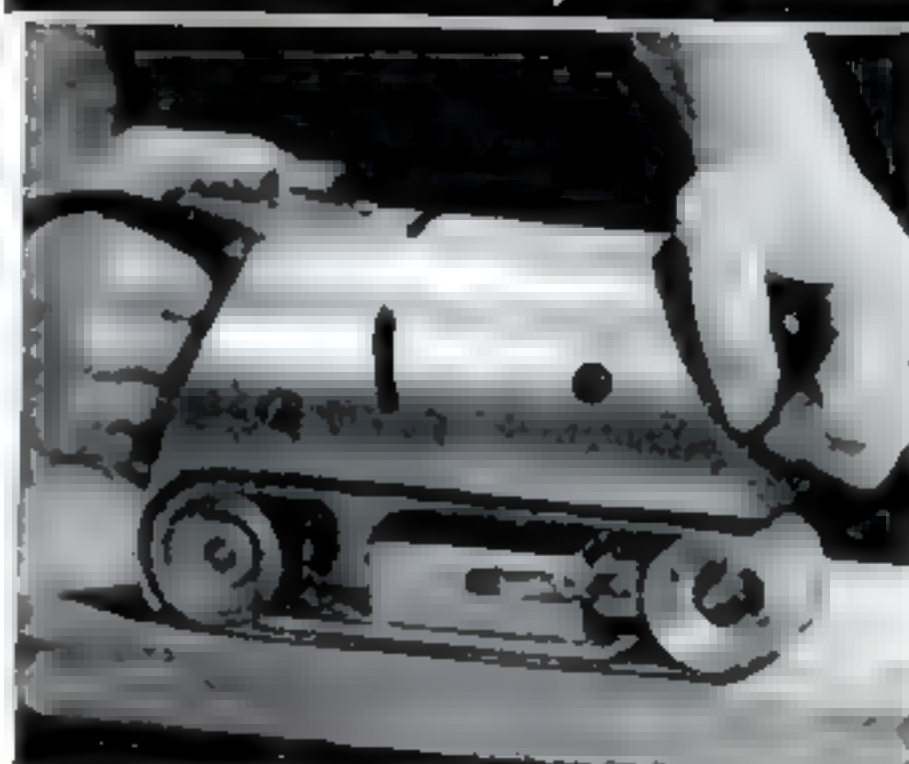
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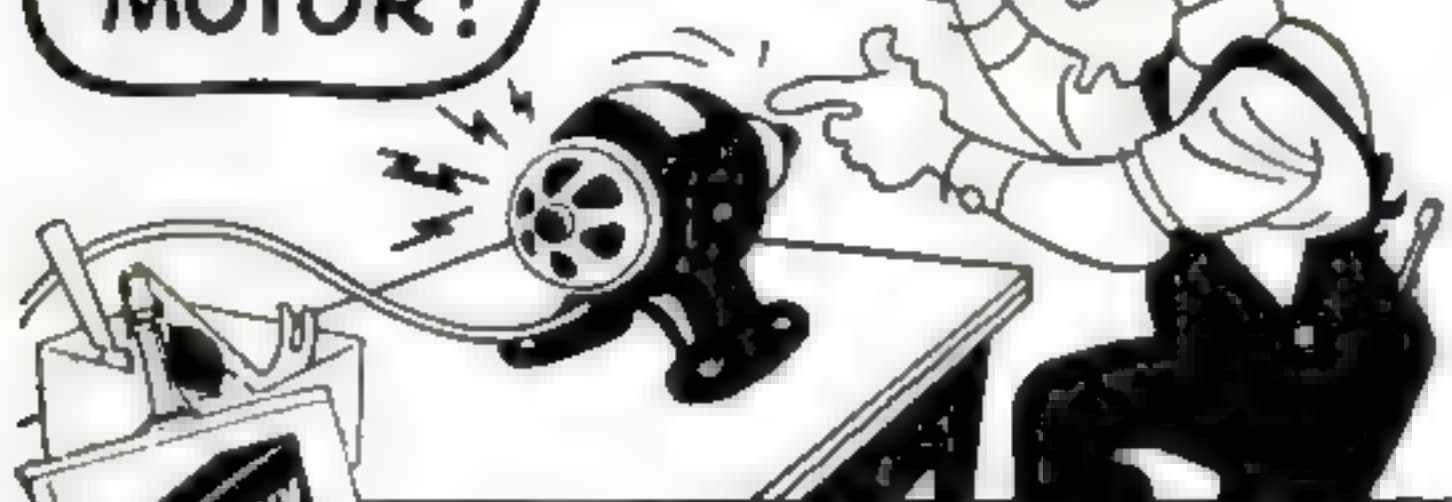
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BAND INSTRUMENTS

Old Bill Says



ONE or two dial indicators and a reading glass, if kept in the right position for convenient use on a grinder, milling machine, or lathe, are a step in the direction of obtaining high-price precision at low cost.

The polishing of small parts in quantities is now being expedited to a marked degree by using a roughing, a semifinishing, and a finishing wheel mounted on one arbor.

High-speed steel milling cutters will never be cheap enough not to make at least one salvaging operation economical.

A newly developed twist drill with an extra thick web is said to aid in drilling stainless steels and monel metal, which give ordinary drills a terrific licking.

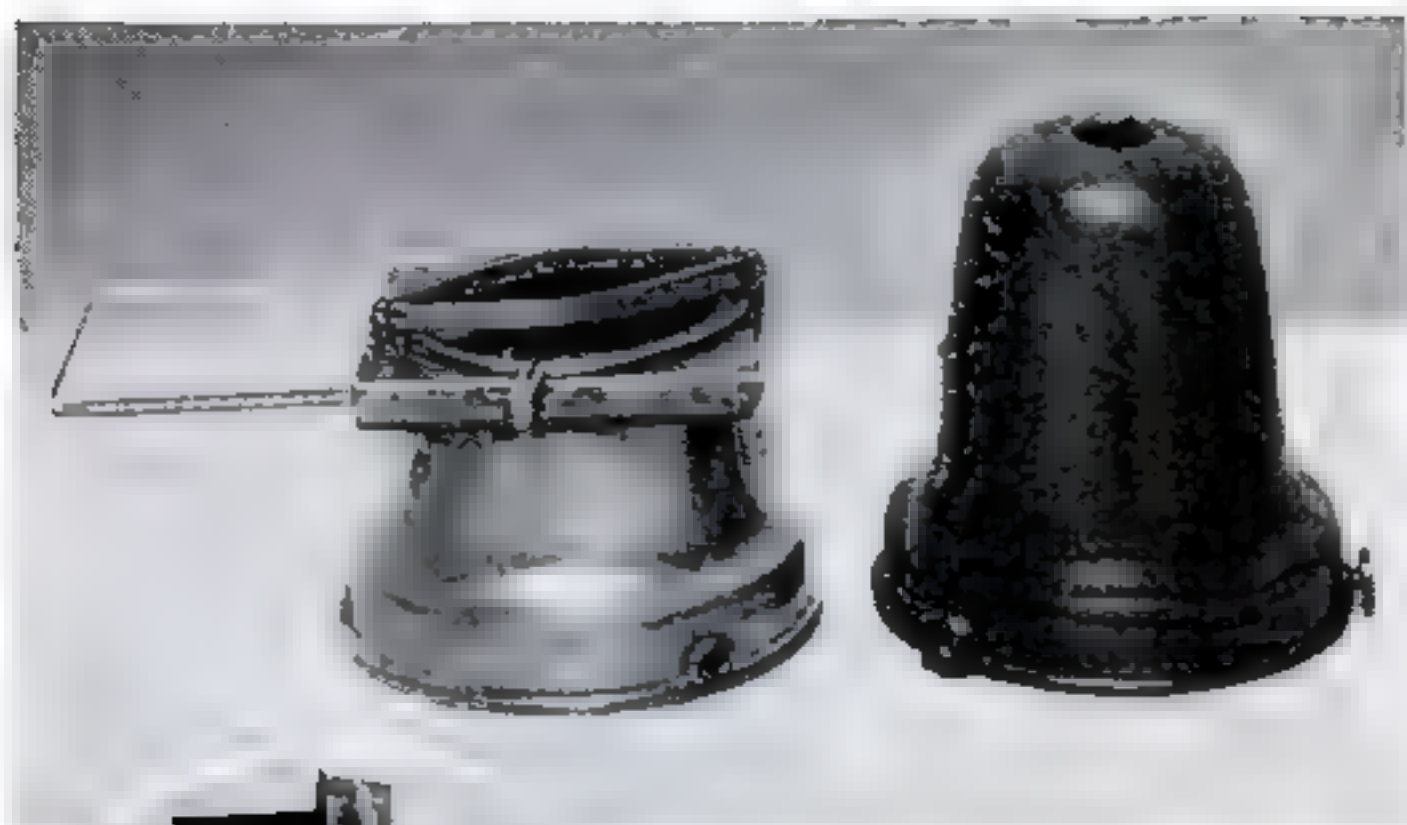
When you hear the "big boss" say, "I'm only forty, but I look fifty and feel like seventy!" there's something wrong with his outfit.

The speed and feed of planing operations can often be surprisingly increased with less heating and strain if two bits are fitted in line into the tool holder and adjusted so as to divide the cut between them.

It is worth knowing that parts of tools made from nitriding steels and properly nitrided will remain "file hard" when reheated up to 1,200 deg. F., whereas ordinary alloy steels get a setback when drawn at some 400 deg. F.

Hints on Avoiding Failures in Oxyacetylene Welding

THE metal forming a weld made with the oxyacetylene torch has the characteristics of a casting of whatever type of metal is being used. If it is merely of the same cross section and composition as the parent metal, it is not as strong; and even if it is built up to twice the thickness of the original piece, internal strains may cause it to fail when subjected to hard usage. It is therefore important to execute the weld so the applied metal is under no strain after cooling, or else it should be carefully annealed.—W.C.



A shade clamp of the type shown above at the right is cut down and combined with a standard filter holder

The device is efficient and neat in appearance

Combination Lens Hood and Filter Holder

AN ADJUSTABLE glass filter holder of the type shown may be combined with a lens hood made from a discarded shade clamp salvaged from an old chandelier or other lighting fixture. The rounded end of the shade clamp is cut off with a hack saw $1\frac{1}{2}$ " from the open end, and the burrs are filed off. A piece of brass is cut the same size as the filter holder, and in it a hole is bored slightly smaller than the opening in the shade clamp. The small end of the shade clamp is soldered over the hole, and the plate is soldered to the filter holder. Clean the assembly with file and wire brush, paint the inside of the hood dull black, and polish the outside with a good brass polish.—LOUIS SONKOY.

Spring Clip on Tripod Holds Dark Slide

"WHERE in the world did I put the dark slide of this cut-film holder?" is a question amateur photographers often ask after they have made an exposure. It may be in their pocket, lying on the ground, or almost anywhere nearby. This would not happen, however, if they fastened a strong spring paper clip to the upper part of one of the tripod legs and made a practice of always placing the slide in the clip after being withdrawn from the camera.—E. V. B.



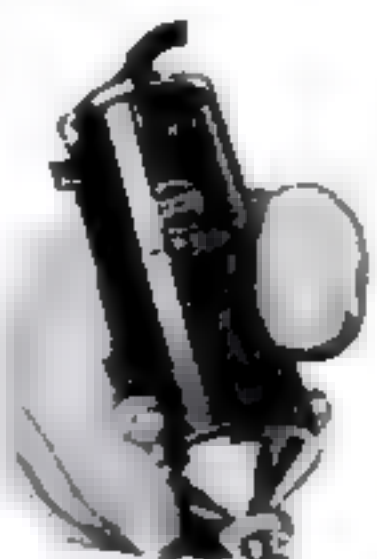
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business comes through store-cards, folders and repeat orders," writes K. Andersen. As little as \$88 puts you in OWN business—pay balance from profits. We furnish electric machines, circulars, store-cards, demonstrators and materials to quickly return TOTAL investment with large profit. Clear \$2 to \$5 an hour profit in lifetime business. FREE booklet explains everything. Write TODAY while territory is open.



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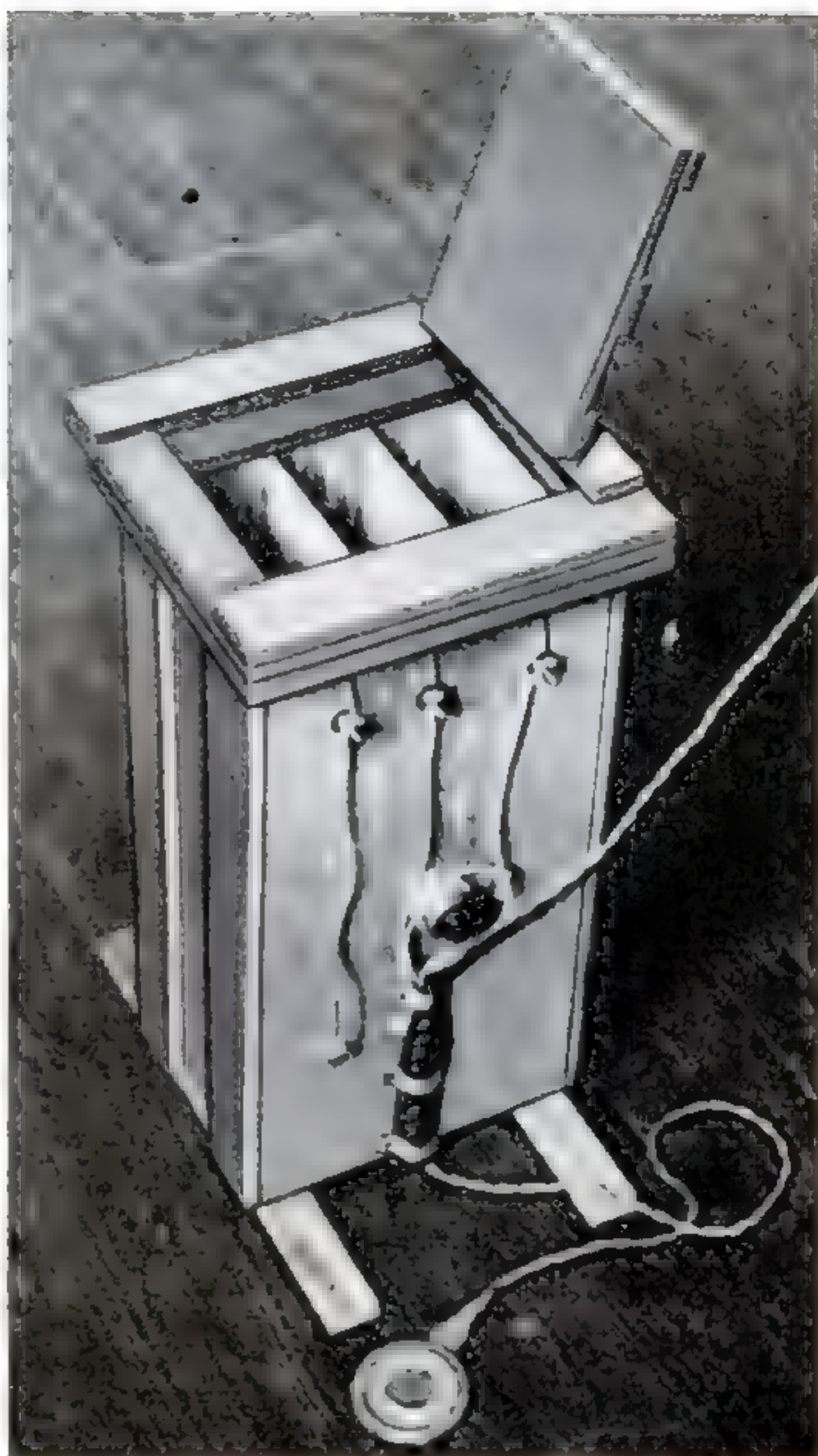
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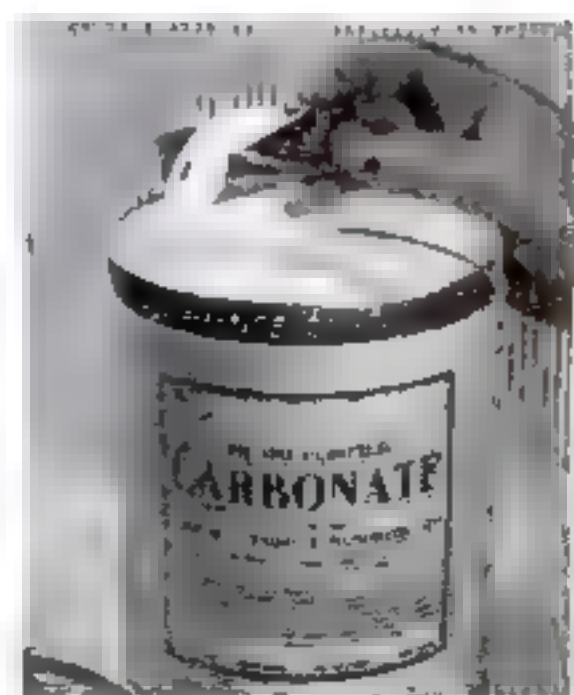


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FOR a school yearbook, three different negatives of class groups are printed on one sheet in the homemade photo printing box illustrated. The finished sheets are bound as inserts in the book and save the expense of having halftone plates made. Since the negatives may be of different density, each compartment in the box has its own lamp on a platform which may be moved up or down to vary the illumination.—C. W. RICKMAN.

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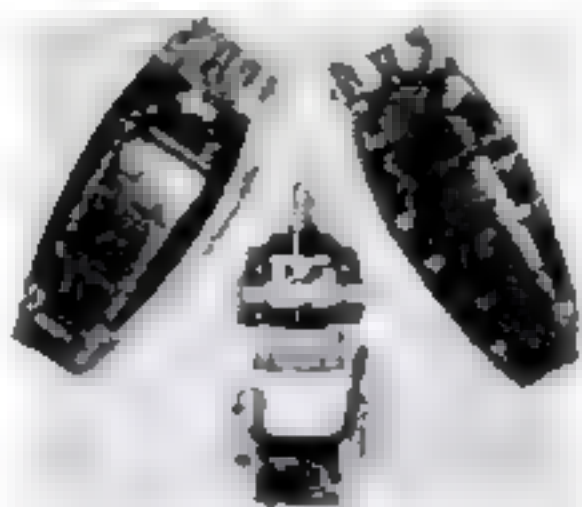
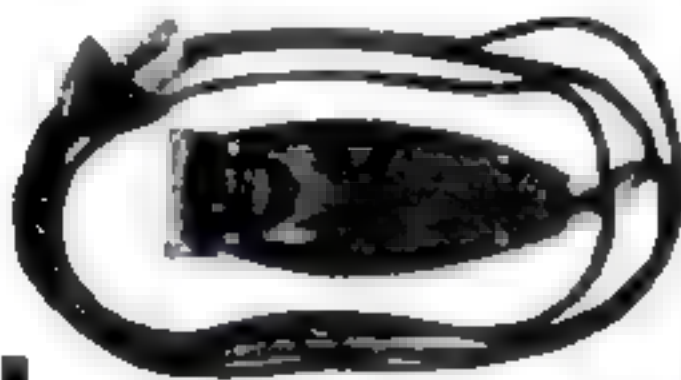
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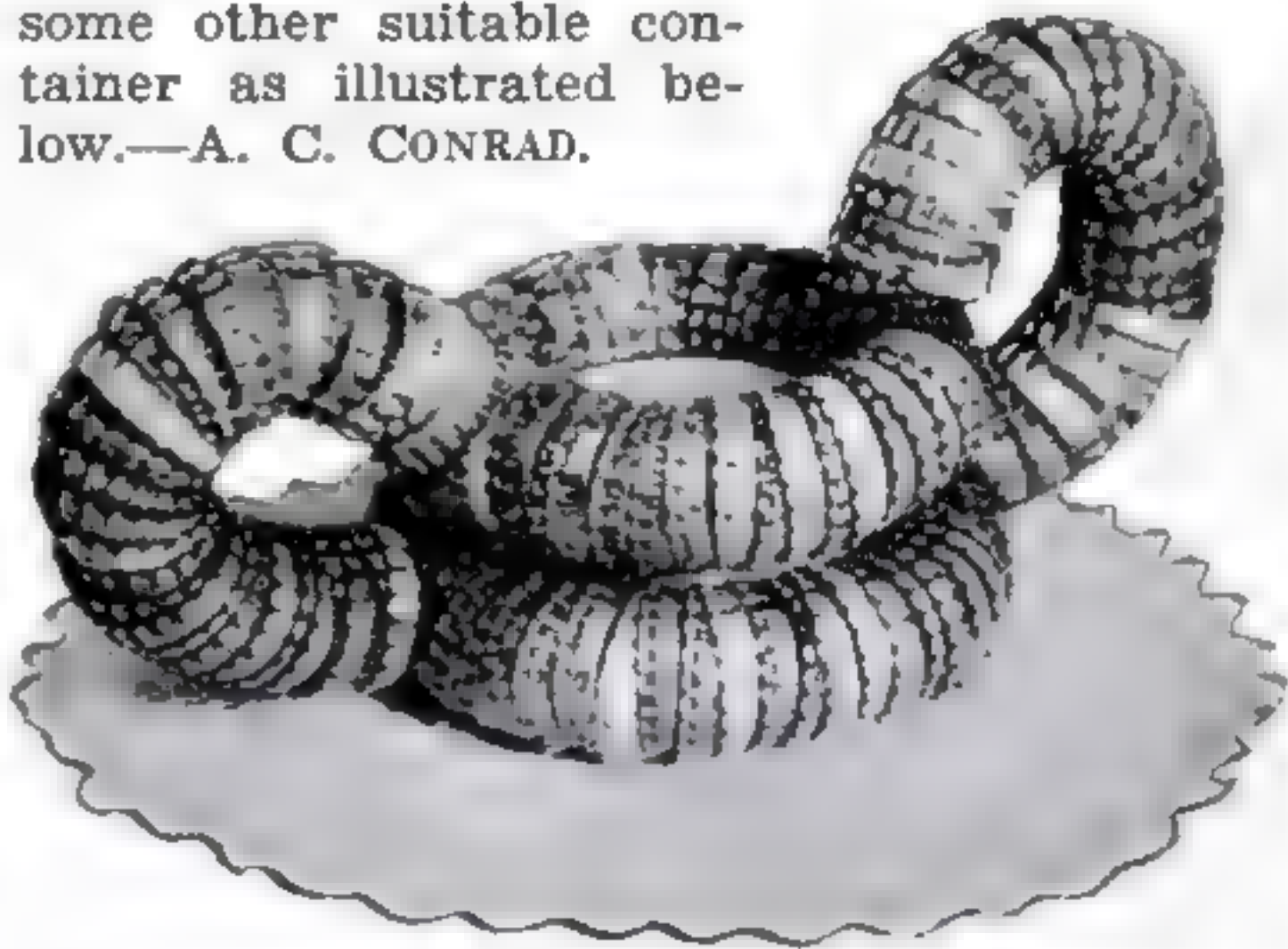
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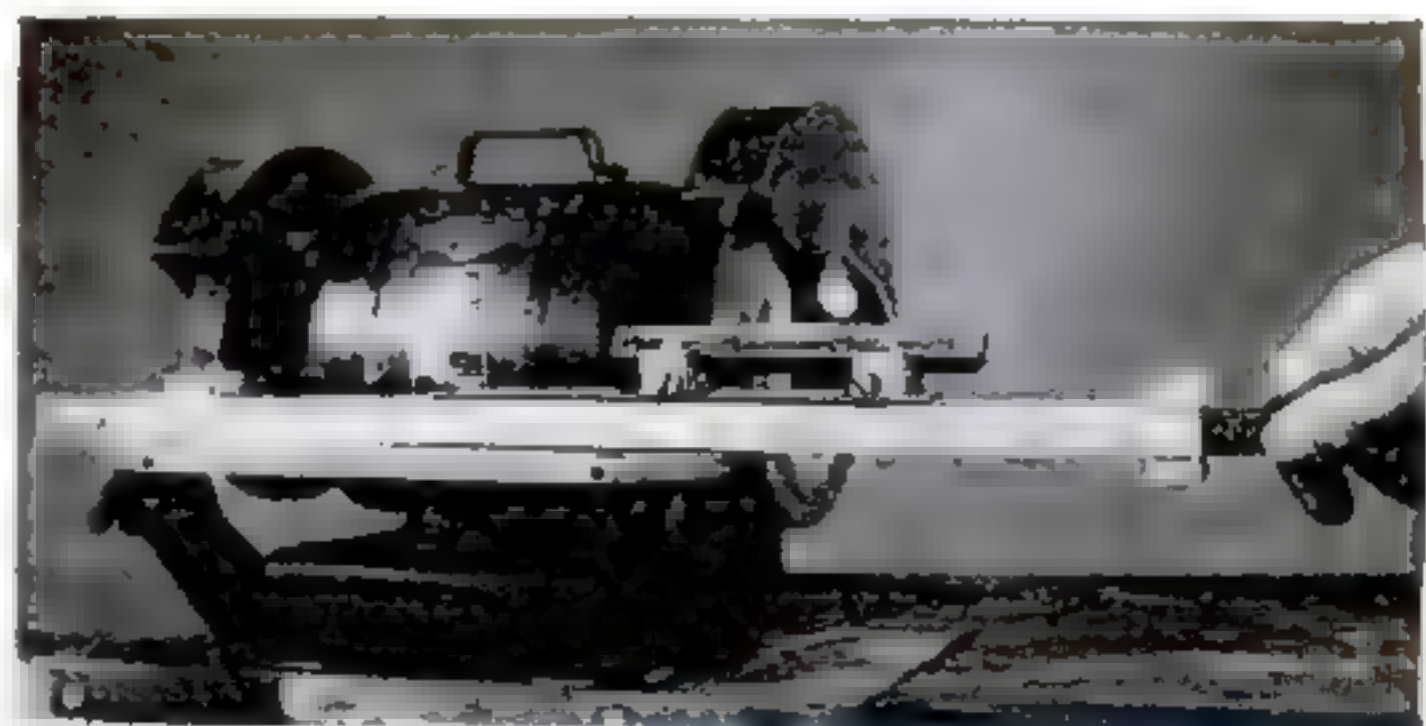


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WITH a jig made as illustrated below, any amateur woodworker who owns a jointer can hollow grind the jointer knives ready for finishing them to a razor edge with a few strokes on an oilstone. The base has two studs that fit the tool-rest clamps on the grinder. On this are screwed two iron bars, and a third longer bar slides between them. On the central bar is a brass channel in which the three blades are clamped with four set screws. This channel is supported by two slotted blocks at a 30-deg. angle, and set screws are provided for adjusting the relation of the blades to the grinding wheel.

The blades are rough ground in one, two, three order; then a finishing cut is made by moving the channel forward from 0.001" to 0.002". One advantage of keeping the three blades in the holder at all times is that the block of metal absorbs the heat.—C. W. H.



The jig is mounted on the grinder, and the three jointer blades are clamped in place with screws

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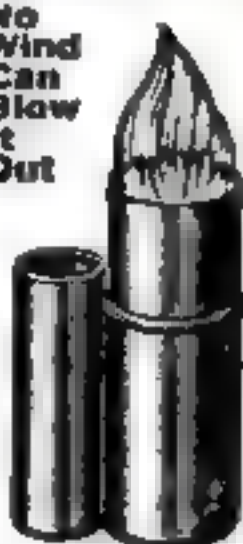
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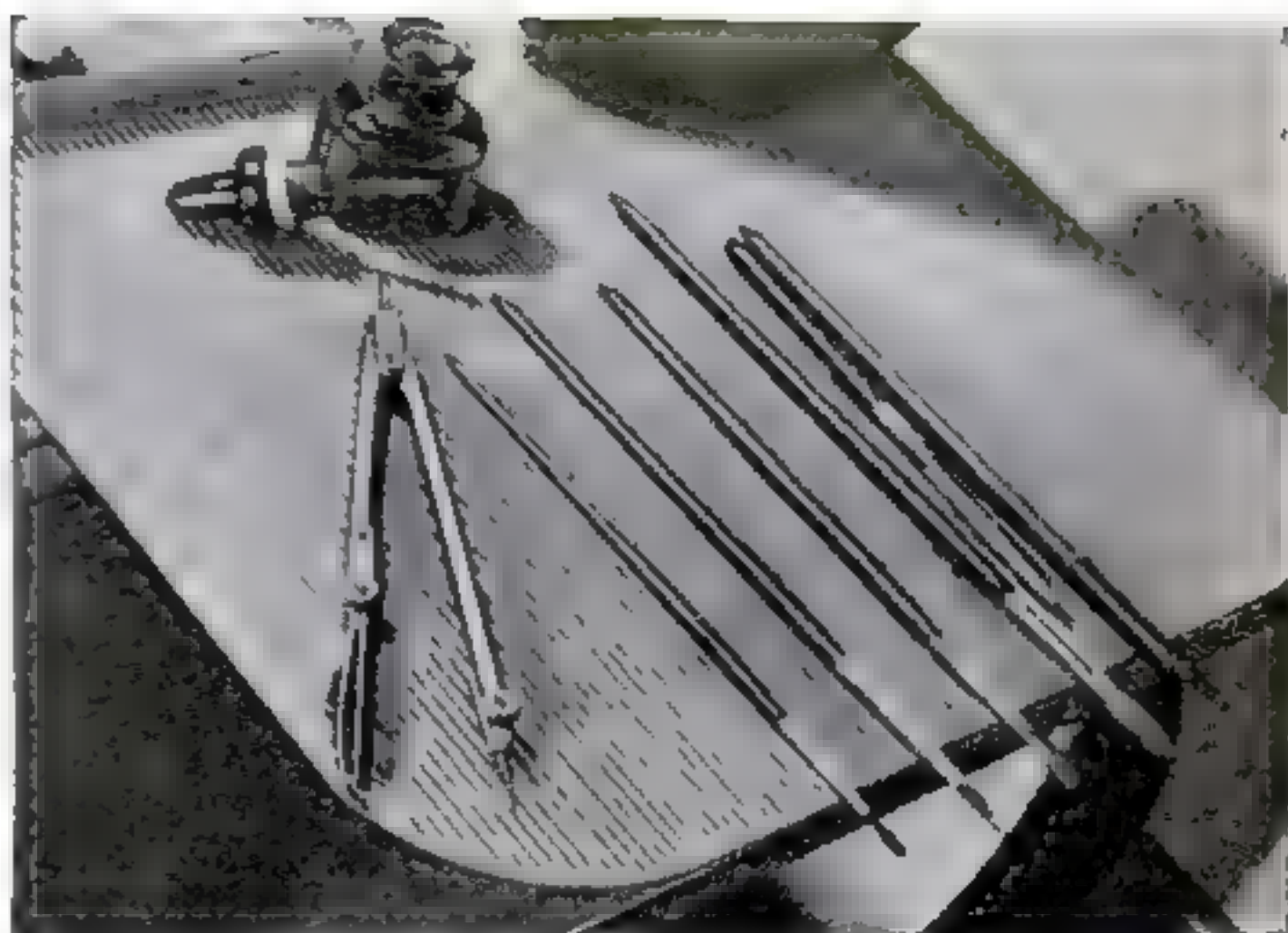
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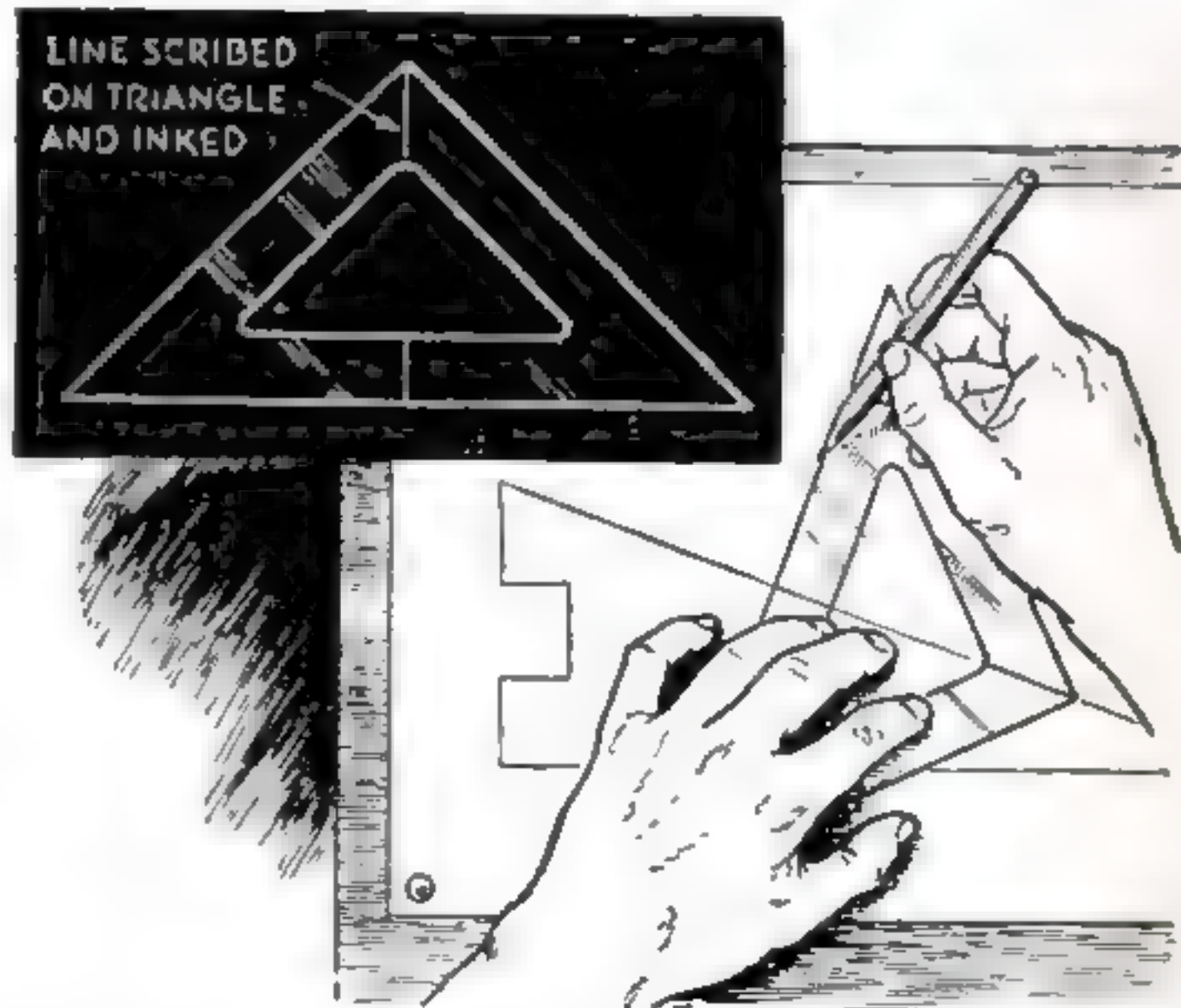
TO KEEP pencils, pens, and brushes from rolling off an artist's table, try a corrugated rubber bath mat. The corrugations tend to hold the implements in the grooves, lined up in regular order so as to be easy to distinguish at a glance. The mat has the additional advantage of being easily washed.—S. R. B.

Fastening Hammer Handles

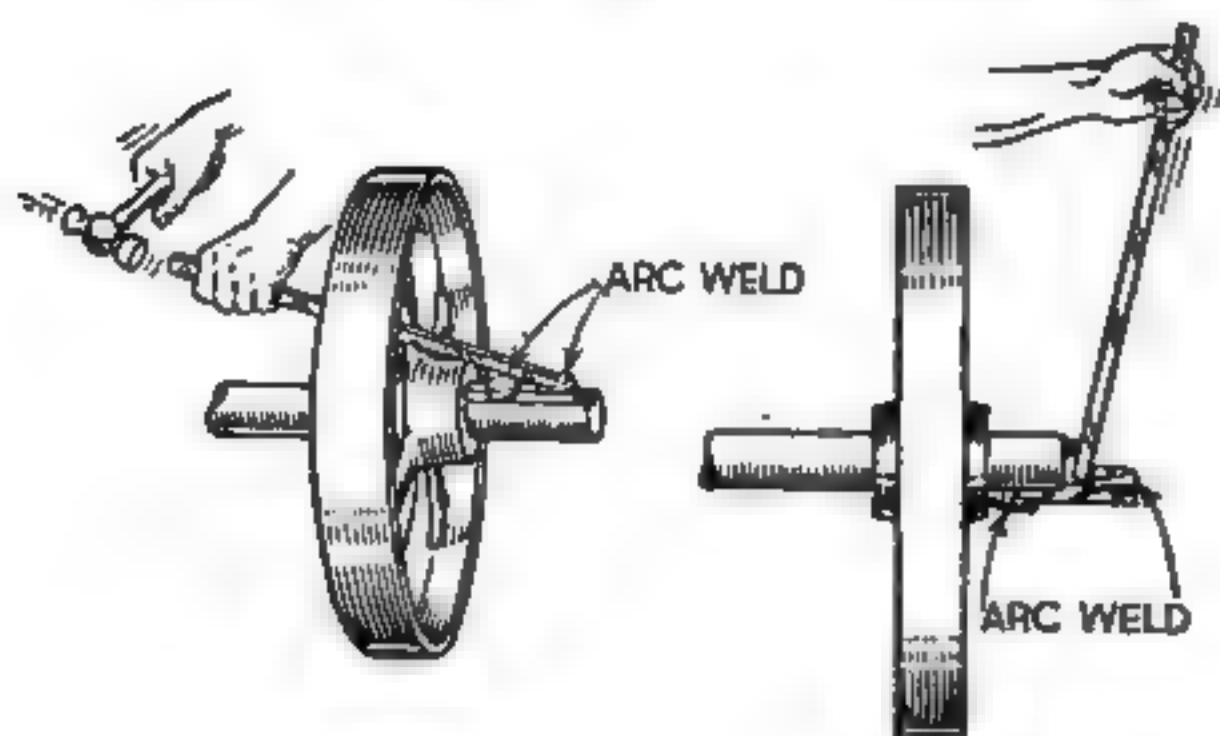
A SNUG-FITTING hammer handle may be fastened without a wedge by driving closely spaced finishing nails into the wood all around the end, close to the metal.—W. M.

Perpendicular Line Improves Draftsman's Triangle

IF A LINE is scribed perpendicular to the longest side of a draftsman's celluloid triangle and inked to make it easy to see, it will prove of great aid in quickly drawing lines perpendicular to other lines that are awkwardly placed on a drawing.—E. E. MCNUTT.



Stubborn Keys Removed with Aid of Welding



TIGHT machine keys or keys with broken gibs may be removed by arc welding an extension of the same width as the key stock onto the exposed end of the key and then welding a straight piece of rod to the extension so that it can be driven with a hammer.

When the key is so located that a rod cannot be used in this way, make the extension long enough to pass the end of the shaft and weld a short piece of key stock to the underside so that the key may be pried out by using a lever over the end of the shaft. In making the welds, use electrodes of high tensile strength.—S.R.

Resilvering Small Mirrors

IT OFTEN becomes necessary to resilver the small mirror used in a microscope, sextant, or other instrument of precision. Place a piece of tin foil about $\frac{1}{4}$ " larger in each dimension than the glass to be silvered on a somewhat larger piece of glass. Smooth out the foil carefully by rubbing with the tip of one finger. Put a small drop of mercury on the foil and spread it with the finger over the entire surface, but see that none of the mercury runs under the edges; then put on a few more drops of mercury until the whole surface is fluid.

The glass, having been carefully cleaned, is laid upon a piece of tissue paper, the edge of which just covers the edge of the glass. By using the tissue paper to guard against finger prints, the glass is carefully transferred from the paper to the mercury-covered tin foil, and a gentle pressure is exerted. Place the mirror face downward and leave it in an inclined position to allow the surplus mercury to flow off. This operation may be hastened by placing a tiny strip of tin foil along the lower edge of the mirror. After five or six hours the tin foil around the edges may be trimmed away, and the next day a coat of varnish to which some dry paint color has been added should be applied to the surface.—W.W.

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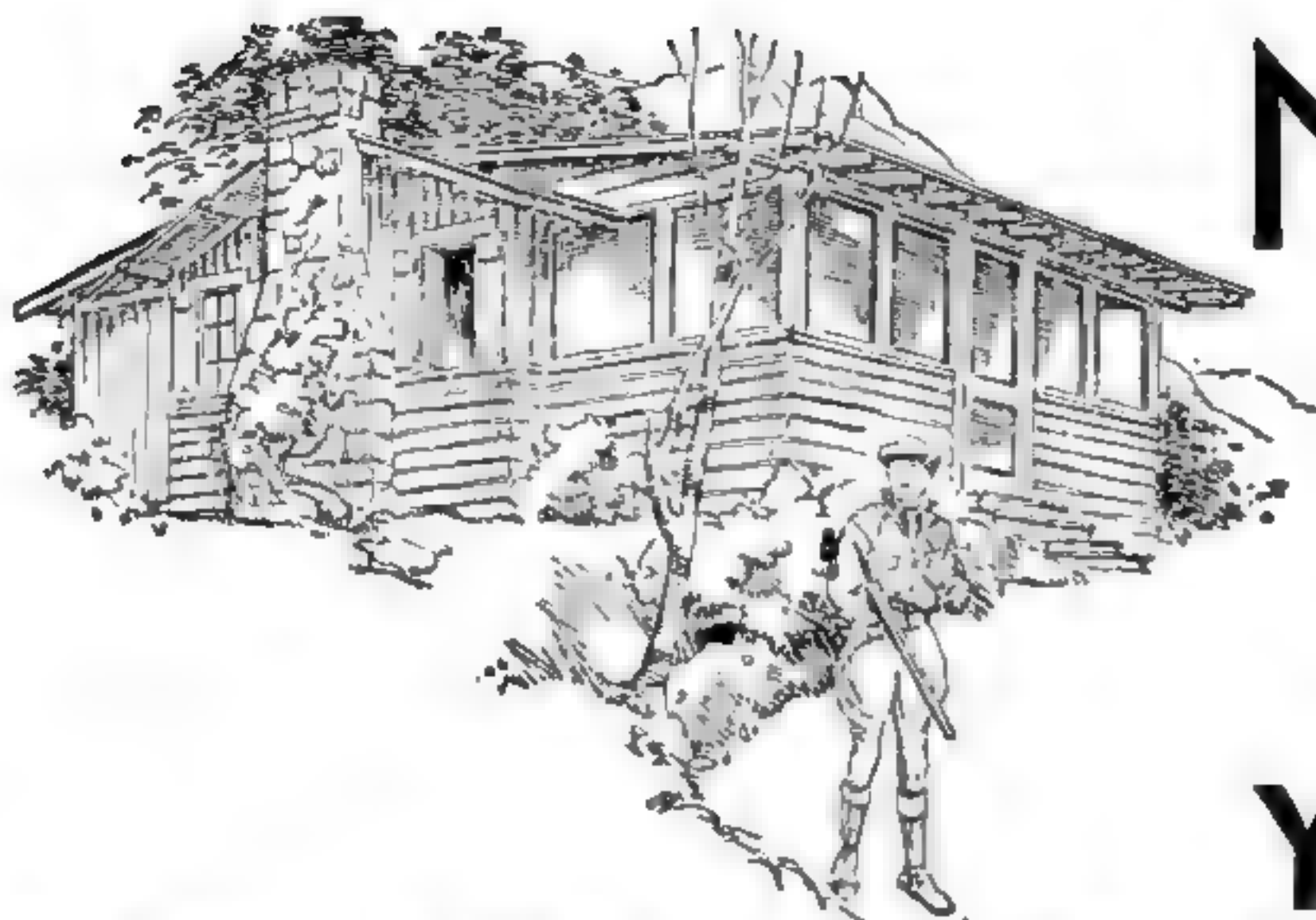
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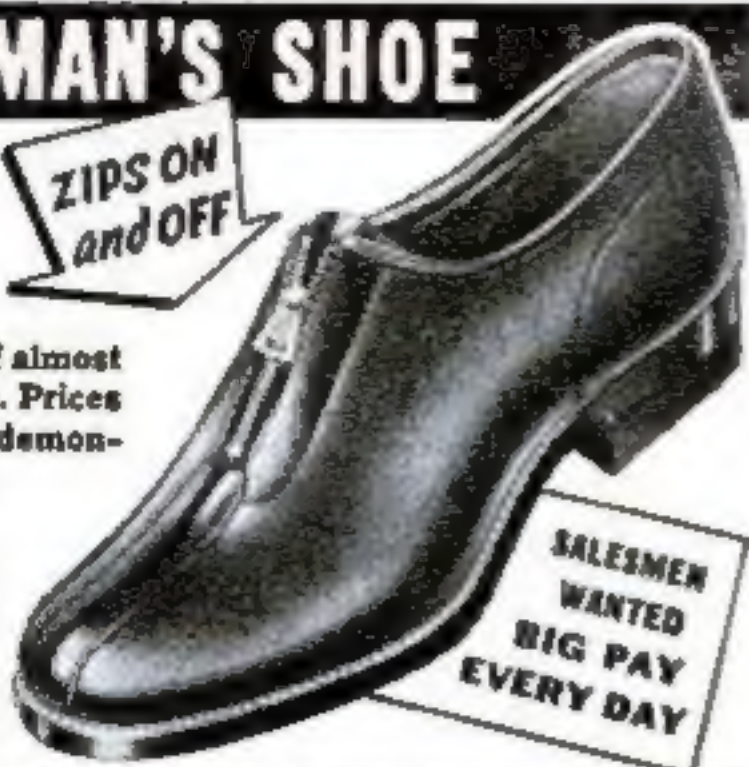
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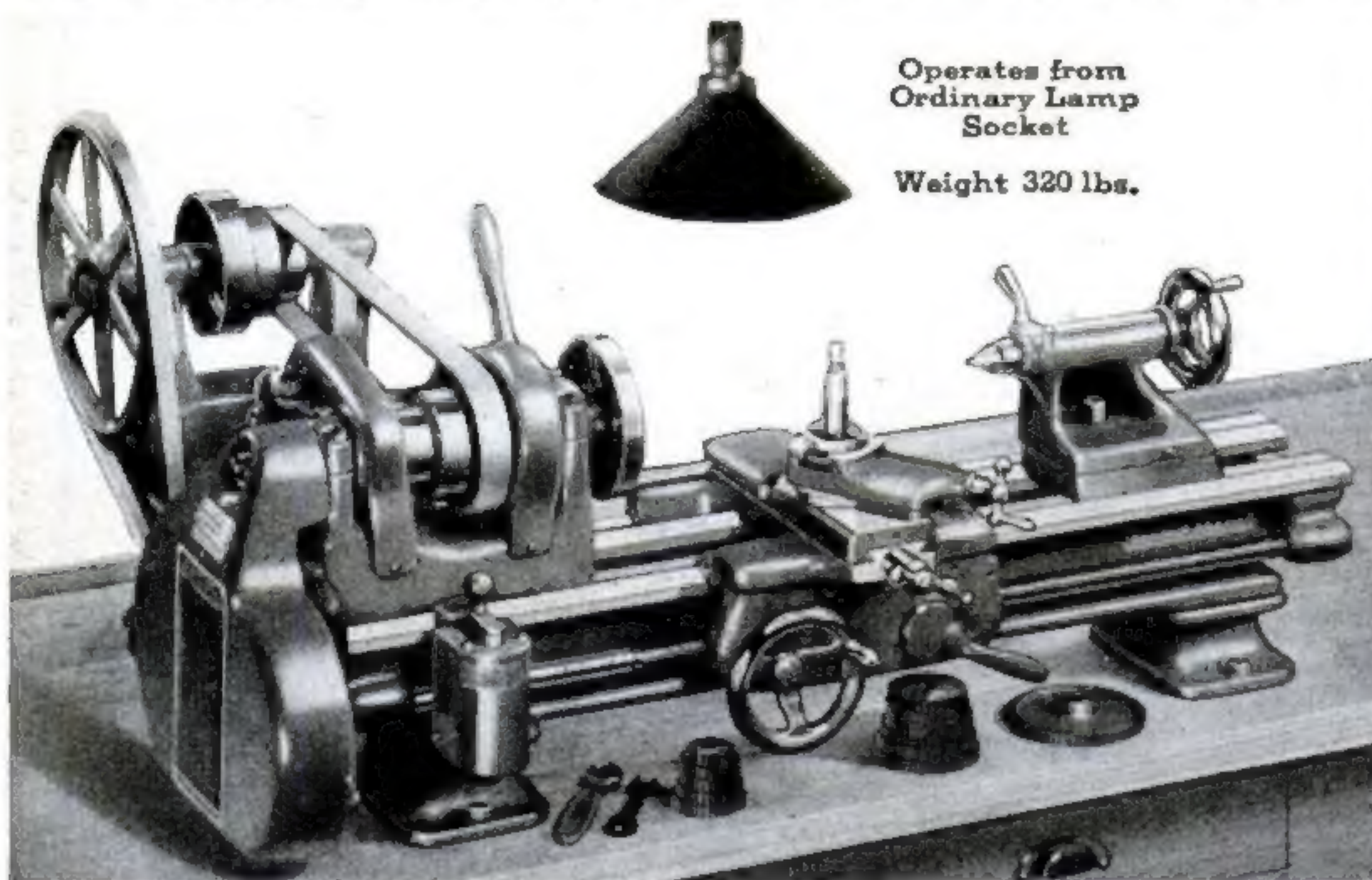
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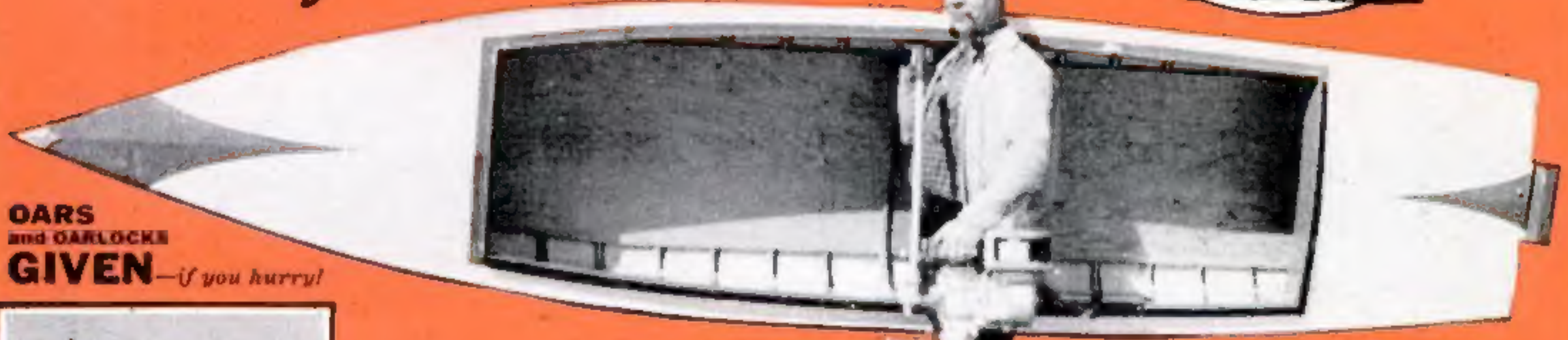
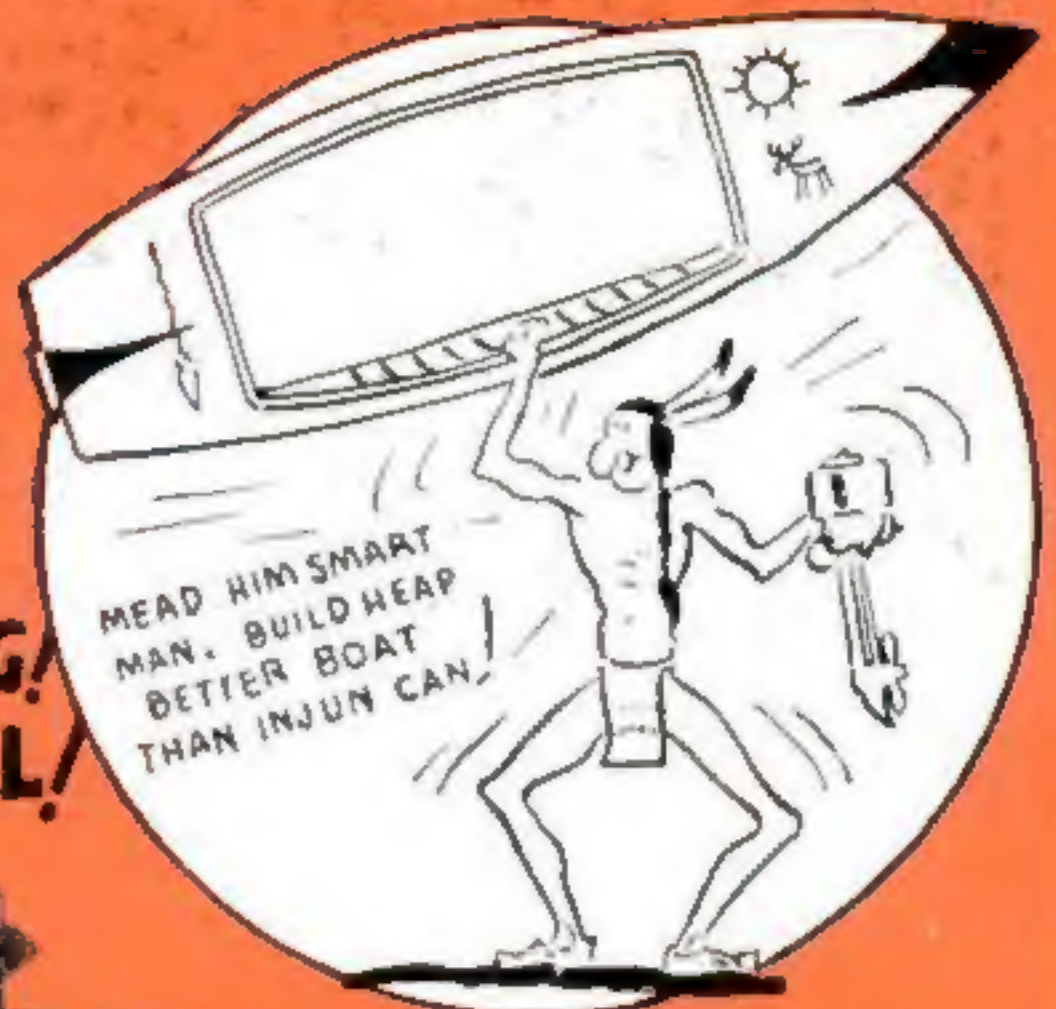


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